Review on Agriculture and Rural Development 2017 vol. 6 (1-2) ISSN 2063-4803

SOME EFFECTS OF NATIONWIDE SMALL RUMINANT BREEDING PROJECT UNDER THE BREEDER CONDITIONS ON GOAT FLOCKS AND THEIR OWNER

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ABSTRACT
The nationwide small ruminant breeding project under the breeder condition has been started in the year of 2005. The project planned to solve some of the problems related with small ruminant breeding system. Especially, to find the solution for inadequate productivity, lack of organisation, insufficient collaborations, low education, and unreliable registration system were the main parts of the mentioned project. Project planned with sub-projects according to districts and breeds. At the beginning, project started with sheep flocks, and then goats were included. Local sheep and goats associations were involved the project. Project personals were chosen and educated according to project rules. Also, meetings were organised with the selected breeders and the breeders were informed about the projects and their duties. In our region we were examined the goat flocks from the year of 2011 to at the end of 2016. During the period of the project some increases on the live weights of the animals have been detected. Also, breeders directly or indirectly had education about their job. At the end of the scheme, some of the positive effects of the project have been observed on the lives of breeders, goats, collaborations and market situations.

Keywords: Turkey, breeder condition, goat, nationwide project

INTRODUCTION

Small ruminant and their various products are important for both developing and developed countries. Generally small ruminants reflect the characteristics and the culture of a population or vice-verse. The importance of small ruminants breeding system and their positive effects on the social life, economic level and well-being condition of people in developing countries has been mentioned by researchers (BOYAZOGLU ET AL., 2005, KOSGEY ET AL., 2008, KOSGEY, 2004). Small ruminants are also important for the utilisation of the lands where other farm animals cannot. Additionally, regions where crop production is impractical can easily be use by small ruminant as food resources (BAKER AND REGE, 1994). Therefore, improvement local, regional, and nationwide programmes are necessary to increase and sustain the productivity of small ruminants. Constant improvement is related with genetic progress and genetic improvement programmes for sheep and goats will only be successful when accompanied by a good understanding of the different farming systems and when simultaneously addressing several constraints such as feeding, health control, general management, and cost and availability of credit and marketing infrastructure (KOSGEY ET AL., 2008, BAKER AND GRAY, 2004).
As a farm animal, goat has special qualifications in terms of breeding, production, cultural addition and social perception. Moreover, keeping goat is linked with socioeconomic and recreational requirements of the country people (DEVENDRA, 1998, KIVRAK, 2014). Goat rearing in Turkey is one of the hardest rearing systems. This system is conducted in harsh environment and whole family of the breeders involve this activity, as can be seen in the life of nomadic goat breeders. This explained livestock practice is still active with almost all structures in West Mediterranean part of Turkey.

All the applied projects on the small ruminant population in the rural area more or less affect their owners in terms of various factors. Similarly, nationwide small ruminant breeding project under the breeder conditions affected both goats and their keepers. These effects can be measured on the traits of goats and the life style of the keepers.
This study aimed to detect and illustrate all the defined changes for both goats and breeders using the data and situations before and after the mentioned project.

MATERIAL AND METHOD

Effects of the nationwide small ruminant breeding project under the breeder conditions were investigated in West Mediterranean region of Turkey. Investigation was carried out in the cities of Antalya, Burdur and Muğla. Generally, areas on the Taurus Mountains were included the study. Local Hair and Honamlı goats and their owners were evaluated. Studied area is the best place to see the entire characteristics of extensive goat rearing system. The flocks for the project have been selected according to breed characters and the rules of the project. In addition, project personal have been educated with successive seminars according to project objectives. Also, breeders have been gathered several times to explain the details of project. The best 10% of male kids and 20% of female kids have been selected from each member flock according to 90 days performance. Those animals were not allowed to be sold and kept in the flock as breeding animals for next generation. Performances of goats were measured beginning and at the end of the project. All the measurements have been illustrated in the Tables as digital data. Changes in the lives of the breeders were also defined with comparative observations. Some dramatic changes were observed and documented with the onsite pictures.

RESULTS

Collected and formed performance data before and after the project have been showed in the *Tables 1* and *2*.

Table 1. Changes in the birth weights and 90th day live weights

		Birth Weight		90th Day Weight
		Mean±SEmean		Mean±SEmean
Hair Goat	n			
2012	8989	3.25 ± 0.01	8185	15.40± 0.06
2016	14342	3.24 ± 0.01	13722	16.74± 0.06
Honamlı Goat	n		n	
2012	8425	3.49± 0.01	7457	17.50± 0.06
2016	10370	3.46± 0.01	9842	18.91± 0.06

Table 2. Changes in reproduction traits

	Number of kidding does	Number of single kidding does	Single birth rate (%)	Number of twin kidding does	Twin birth rate (%)	Number of kids	Litter size
Hair Goat							
2012	8555	8120	95.0	435	5.0	8990	1.05
2016	8910	8059	90.4	851	9.6	9761	1.10
Honamlı Goat							
2012	7551	6677	88.4	874	11.6	8425	1.12
2016	9130	7892	86.4	1239	13.6	11680	1.27

Investigated production and reproduction traits showed a modest increase from the beginning of the project to the end of it. This project was also an indirect education method for the breeders, because most of them applied some new techniques to their flocks. These methods were discussed in detail in the following section.
Changes in the life style of the breeders and the conditions of the barns have been observed clearly and demonstrated with on-site taken pictures.

Figure 1. Before the project

Figure2. After the project

CONCLUSIONS

Modest increase in production and reproduction traits has been observed in the last year of the project according to previous years. The effects of the applications have been clearly observed in the last year. Selecting the best bucks and best does and culling the weak animals according to kept record, learning how to keep the pedigree and performance records and avoid form inbreeding might cause these increases. With these defined increases, breeders understood the effectiveness of the applied techniques in the project.

Goat rearing in the region is applied according to traditional methods (BOYAZOGLU ET AL., 2005) therefore to teach new techniques to the breeders were not easy. Also, breeders have not easily accepted the implications. When they have seen an objective increase and got benefit from these increases, their intention has become clear to keep up with the project. This situation can be used for the new applications on the small ruminant holders with an important criterium that "In order to make the breeders believe for the results of new applications, the best way is to show them the objective results."

It is a reality that most of the extensive small ruminant breeders' education level is low (BUDAK ET AL., 2005, CAN, 2014). Therefore, applications related to recording system are weak in this society. The project was successful to teach them record keeping and make them continue this application. They also realized the importance and the differences of pedigree and performance records. This achievement might be accepted as education part of the project.

Goat breeders cannot live an intense social life (DEVENDRA, 1998, KIVRAK, 2014). Project gave an opportunity to the breeders to make communication with other breeders and all the partners of the project and the sector. Workshops, fairs, meetings and contests were great opportunity for this kind of relationships. At the end of the project, a valuable understanding among the project partners has been established. This establishment can easily be used to define and to solve the certain problems of the sector.

With this project, the State showed a valuable interest to the small ruminant breeders. This interest is priceless for the breeders, because for a long time they used to think that they are a forgotten child of the State. The interest of State made their confidence durable and their hope alive for the future of this business.

At the end of the project the region and whole Turkey have a bunch of educated small ruminant breeders who are ready for teamwork and scientific collaboration. Breeders understood the importance of recording and its usage in the flocks. Each of the breeders became a member of an association or breeding society. Also, official body got valuable experience to do similar works on the rural area.

Project has significantly affected the life style of the breeders. It has also changed the performance of goats, the houses of breeders, the barns of animals and the perceptions of the breeders. The project has created awareness for both, the State and breeders in term of small ruminant sector.

REFERENCES

BAKER, R.L., GRAY, G.D. (2004): Appropriate breeds and breeding schemes for sheep and goats in the tropics. In: Sani, R.A., Gray, G.D., Baker, R.L. (Eds.), Worm Control for Small Ruminants in Tropical Asia, Monograph, No. 113. Australian Centre for International Agricultural Research (ACIAR), pp. 63–95.

BAKER, R.L., REGE, J.E.O. (1994): Genetic resistance to diseases and other stresses in improvement of ruminant livestock in the tropics. In: Proceedings of the Fifth World Congress on Genetics Applied to Livestock Production, vol. 20, University of Guelph, Canada, August 7–12, 1994, pp. 405–412.

BOYAZOGLU, J., HATZIMINAOGLOU, I., MORAND-FEHR, P. (2005): The role of the goat in society: Past, present and perspectives for the future. Small Rumi Res. 60: 13-23.

BUDAK, D.B., DARCAN, N., KANTAR, M. (2005): Women farmers and extension services in small ruminant production in mountain areas of Turkey. J. of Arid Environments 62: 507–515.

CAN, M. F. (2014): A socio-economic analysis of small ruminant breeders' membership relations and organizational effectiveness. Ankara Üniv Vet Fak Derg 61: 119-124.
DEVENDRA, C. (1998): Improvement of small ruminant production systems in rainfed agro-ecological zones of Asia. Ann. of Arid Zone 37: 215-232.
KIVRAK, R. (2014): Yürüyen Türkler yörükler. Ege reklam basım sanatları San. Tic. Ltd.Şti. İzmir
KOSGEY, I.S., ROWLANDS, G.J, VAN ARENDONK, J.A.M., BAKER, R.L. (2008): Small ruminant production in smallholder and pastoral/extensive farming systems in Kenya. Small Ruminant Research 77: 11–24.
KOSGEY, I.S. (2004): Breeding Objectives and Breeding Strategies for Small Ruminants in the Tropics. Ph.D. Thesis. Wageningen University, The Netherlands, 272 p.

Review on Agriculture and Rural Development 2017 vol. 6 (1-2) ISSN 2063-4803

WHEN TO SELL THE COW?

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ABSTRACT
In Hungary hundreds of thousands of cows produce milk for us. A common disease of them is mastitis that influences their productivity and profitability substantially. The usual practice is to decide on a rule of thumb basis whether the ill cow should be kept or sold. E.g. they are kept till the fifth mastitis case occurs. The present study investigates this problem from a mathematical modelling point of view. The relative amount of the possible lost profit is in the order of magnitude of 10s of percentages, which is quite large, especially regarding the profitability outlooks of the dairy branch.
The problem lies in the personal relationship of the farmers to the cows, and in the complexity of the estimation of the uncertain future scenarios. We present a model that is based on collected historical data on the distribution of several model parameters such as the length of the illness, the amount of medicine needed, the number of inseminations required to get into the next lactation cycle etc. The applied methodology is microsimulation (i.e. we simulate all possible events one-by-one) and stochastic optimization. Our typical result is a suggested decision on the basis of the expected value of the profit/loss for the given animal.
We report on the first results that confirm our research expectations in terms of improvement of the business decision. The ongoing research will focus on a recommendation system type data mining technology that can utilize the local specialties of the actual dairy farm in question, and to validate the additional advantage involved in it.

Keywords: milk production, mastitis, profitability, stochastic optimization, microsimulation

INTRODUCTION

Milk production is a sensitive branch of economy, being on the limit of profitability. To compete in a global economy, with anticipated milk price volatility, production systems need to be efficient regardless of the level of scale (DILLON ET AL., 2008). Several studies show that as milk price drops in a volatile milk price environment the benefits associated with cost control increase (MARCH ET AL., 2017). In the present study we investigate the possibility of effective economic modelling of an important decision: when to sell the cow after a diagnosed new mastitis illness. The folklore rule of thumb is to sell the cow when it is in a very bad shape. According to the RUSSEL AND BEWLEY's (2013) survey in which 229 producers in Kentucky State were asked the producers with large herds (≥200 cows) relied more heavily on information from consultants, nutritionists, veterinarians, and on employee input than did producers with small herds (1 to 49 cows). Based on our experiences in microsimulation (BLÁZSIK AND CSENDES, 2010, ALMÁSI AND PALATINUS, 2010), we have elaborated a simple but hopefully detailed enough model of the decision situation.
As we understand the present situation, if a cow gets ill with mastitis, then the most probable action is to treat it accordingly with proper medicine, and keep the animal – if it is not in a very bad shape. We expect that by careful investigation of the probable future life of that cow we can estimate the probable profit to be achieved by keeping or selling the animal.
We are in an early phase of the planned research, first we wanted to prove the concept

based on realistic data, and show its limitations. Later we plan to extend the system to a data mining and recommendation system based sophisticated method. We shall also complete our model to incorporate the related connecting economic subsystems such as the animal food production and milk processing.

MATERIAL AND METHOD

Material. To collect the data for our study, we have visited dairy farms and used other open sources. We have built a simple but hopefully detailed enough model that is capable to provide the most important factors that influence the economic model. We think the following assumptions are realistic. The settings were meant just for the present investigations, and are subject to be fitted to the actual historic data of the dairy farm where the model will be used to support the decision on the ill cow. Although the milk production of a cow follows a specific curve, the dairy cycle curve, according to our computational tests, to optimise the purchasing decision, we can assume that the milk production is constant within the dairy cycle. At the same time we are also aware of the marginal economic weight of conception rate of cows and longevity, somatic cell counts and mastitis incidence proved to be dependent on the milk yield (FEKETE ET AL., 2012).
We assume that the actual mastitis requires 5 days of healing with a probability of 70%, and 10 days with probability 30%. An additional interval of 15 days is needed to first profit from the milk production. To get ill, we have a daily probability of just 0.05% if it will be the first mastitis of the given cow, 0.1% for the second, 0.2% for the third, and 0.4% probability for all the later illnesses. We have determined these probabilities to fit the measured average number of ill cows around 15 out of 1000 on a farm.
The daily profit of a cow producing milk is composed of 1500 HUF revenues for the milk, minus 1000 HUF for the keeping costs. That gives 500 HUF per day. If a cow is in dry period, that means 0 revenue for the milk, and 700 HUF for the keeping, i.e. 700 HUF loss for each such days. The medicine against mastitis costs around 200 HUF per day. The average lactation cycle length is 305 days, then a rest of 115 days is assumed.
The selling price of a cow is estimated by a simple expression in our model (in thousands of HUF): 400 - 25 times the age of the cow in years - 37.5 times the number of illnesses suffered. We understand that in reality, the selling price is better decided on the classification of in how bad shape the cow is, and also based on its weight.
With these assumed data a cow producing milk for a month gives 15 thousand HUF profit, while the loss for a dry cow is 20 tHUF per month, and a new illness causes 27 tHUF direct loss, plus 38 tHUF loss in the selling price. In this way, an optimal 420 cycle provides a profit of 57 tHUF.
We underline that these data and model settings are not fixed, they serve just for the present study, and are subject to be fitted to the historical data of the given dairy farm in real life situation. We expect more additional profit due to our decision support method once the specialities of the given case are accounted for.

Method. With our microsimulation model we investigate the possible best way to decide when to sell the ill cow. The basis of our technique is to simulate the life of a cow on daily basis. In other words, we start with a cow of a given age, number of already suffered mastitis illness, and in a given phase of the dairy cycle. For each day we draw a pseudo random number to decide whether we consider the animal ill. Once having mastitis, we start with a cure. The length of the cure is also decided randomly, following the simple model we gave in the materials subsection. After a proper dry period, the milk production will resume. The cycle of that cow ends by its selling. The date of the purchase is

determined by our simple rule of thumb: we sell the cow if it reaches either the 6th mastitis, or its 10th year of living. The selling price is calculated by the formula given in before: 400 – 25 times the age in years – 37.5 times the number of illnesses.
Having a model for the financial description for a cow, we simulate 100 times the possible outcome to have an approximate stochastic description of the distribution function of the profit. Then we can determine an optimal decision on the expected achievable profit. This microsimulation approach is similar to that used to investigate whether a time based ticket system is better than the existing trip based on in public transportation in Szeged (BLÁZSIK AND CSENDES, 2010, ALMÁSI AND PALATINUS, 2010). The coding was made in Java language, and the simulation programs were run on a blade server.

RESULTS

The distribution of the cumulated profit is depicted on *Figure 1*. We started with a three years old cow entering the first illness in the 161th day of the dairy cycle. The 100 independent simulations provide a stochastic description of the possibilities. On *Figure 1* we can see the least and the most profitable cases together with the average and two more quartile curves. The increasing segments indicate milk production, the decreasing segments illness or resting phases. Also, the repeated cures can be noticed.

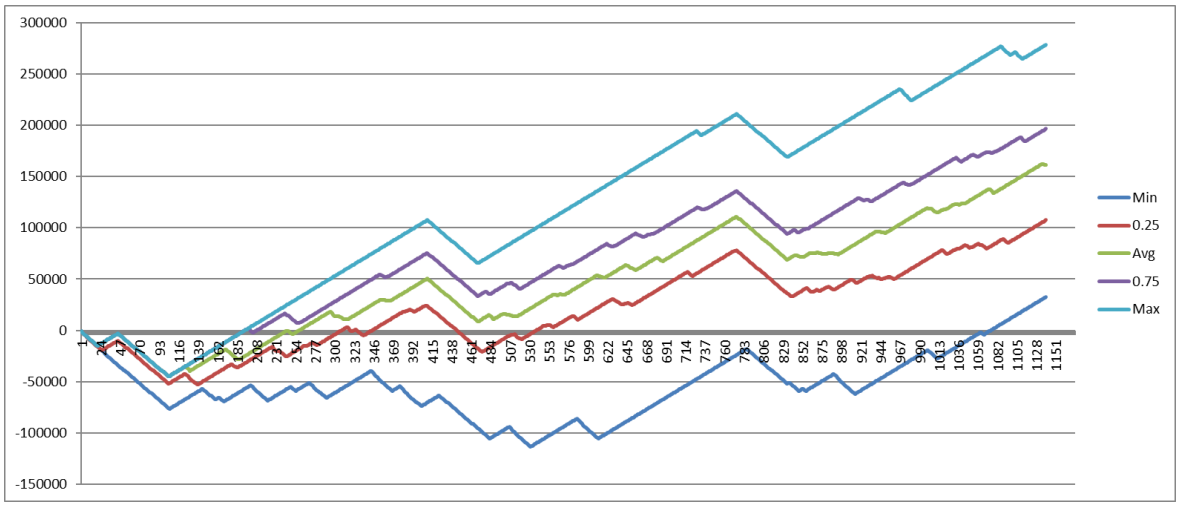

Figure 1. Cumulated profit of a cow in HUF according to the days spent in the farm. The minimal, maximal, average and 2 further quartiles curves of the distribution are depicted. These results were obtained based on 100 independent simulations of the probabilistic events in the model.

Table 1. The expected profit in HUF as the function of the age of the cow, the day of the dairy cycle in which mastitis is detected, and whether the decision is to sell or hold.

Age	3 years		4 years		5 years	
day of the cycle	sell in HUF	hold in HUF	sell in HUF	hold in HUF	sell in HUF	hold in HUF
150.	225,000	244,045	212,500	243,320	200,000	211,730
250.	225,000	219,090	212,500	223,955	200,000	178,665
270.	225,000	236,275	212,500	189,765	200,000	195,025
300.	225,000	212,510	212,500	190,380	200,000	185,515

As a next test, we analysed how the dairy cycle phase and the age of the cow influence the difference between the rule of thumb and microsimulation based decisions. *Table 1* summarizes the results. The green colour indicates cases when it is better to hold the cow for further production, and red signs cases when it is better to sell her right now. Note that here the rule of thumb was to sell when the 4th disease or the 6th year was reached.

Table 2. The expected profit as the function of the serial number of the illness and the age of the cow, and whether the decision is to sell or hold.

illness	3 years, in HUF		4 years, in HUF		5 years, in HUF		6 years, in HUF	
1	287,500	594,540	262,500	517,660	237,500	421,115	212,500	381,645
2	250,000	515,710	225,000	443,640	200,000	352,835	175,000	330,700
3	212,500	392,740	187,500	359,130	162,500	269,240	137,500	250,245
4	175,000	246,885	150,000	191,855	125,000	148,265	100,000	129,375
5	137,500	72,250	112,500	45,350	87,500	18,800	62,500	-3,005

Another aspect was studied in *Table 2* for cows in the 261th day of the dairy cycle. With based on fixed dairy cycle phase, and the rule of thumb to sell the ill cow when it is either the sixth time ill, or it is already 10 years old, we can register profit differences on the magnitude of 60-70,000 HUF.
The simple program that is capable to solve such problems with straightforward input data is available for smart phones and tablets (having Android 6.0 or newer operating systems) at

www.inf.u-szeged.hu/~banhelyi/Buu

We shall update it regularly, and we also plan to implement the application in such a way that also earlier versions of Android should run it.

CONCLUSIONS

We report the first results obtained by our microsimulation model that confirm our research expectations in terms of improvement of the business decision. On realistic data and setting, the suggested new methodology can achieve 60,000 to 70,000 HUF more profit per cow – compared to folklore rule of thumb decisions. The ongoing research will focus on a recommendation system type data mining technology that can utilize the local specialties of the actual dairy farm in question, and to validate the additional advantage involved in it. The future research will also consider the stochastic optimization (CSENDES ET AL., 2008) of the rule of thumb parameters.

REFERENCES

ALMÁSI, B., PALATINUS, E. (2010): Computational Modelling of the Economic Effect of the Travel Time Based Ticket System (In Hungarian). Student Research Competition (TDK) University of Szeged.
BLÁZSIK, B., CSENDES, T. (2010): Economic Modelling of the Transition from a Travel Times Based to a Ticket System. Research Report for the Szeged Transportation Inc., in Hungarian (Az utazásszám alapú jegyrendszer időalapú jegyrendszerré történő átállításának gazdasági modellezése), KNRet, Szeged.
CSENDES, T., PÁL, L., SENDIN, J.O.H., BANGA, J.R. (2008): The GLOBAL Optimization

Method Revisited. Optimization Letters 2: 445-455.
DILLON, P., HENNESSY, T., SHALLOO, L., THORNE, F., HORAN, B. (2008): Future Outlook for the Irish Dairy Industry: A Study of International Competitiveness, Influence of International Trade Reform and Requirement for Change. International Journal of Dairy Technology 61(1): 16-29.
FEKETE, Z., BAUMUNG, R., FUERST-WALTL, B., KELLER, K., SZABÓ, F. (2012): The Effect of Milk Yield on the Profitability and Economic Weight of Selected Traits. Zuchtungskunde 84(6): 463-473.
MARCH, M. D., SHALLOO, L., ROBERTS, D. J., RYAN, W. (2017): Financial Evaluation of Holstein Friesian Strains within Composite and Housed UK Dairy Systems. Livestock Science 200: 14-22.
RUSSEL, R. A., BEWLEY, J. M. (2013): Characterization of Kentucky Dairy Producer Decision-making Behavior. Journal of Dairy Science 96(7): 4751-4758.

Review on Agriculture and Rural Development 2017 vol. 6 (1-2) ISSN 2063-4803

STUDY REGARDING AGRICULTURAL PRODUCTION FROM CARAS-SEVERIN COUNTY

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ABSTRACT
The present paper wishes to present objectively, through the medium of analyze, the situation of agricultural production from Caras-Severin County. Like all over the country, in Caras-Severin County it practices a subsistence agriculture, underperforming, for self-consumption. The lack of association and weak technological equipment, the large number of elderly farmers, does not allow the practice of an efficient and competitive agriculture. Even if Caras-Severin County is the third as largest on the country, in terms of agricultural area, this being only 396.915 ha, occupies only 13th place thanks to the relief mostly mountainous. From the data presented in this article it can be seen that the agricultural production of Caras-Severin County has registered an upward trend in the 2010-2013 period, after which its level decreased in the year 2014 due to the decrease of agricultural production animal and vegetable, but it can notice an increase of agricultural services in this year.

Keywords: agriculture, agricultural production, animal production, crop production, agricultural services

INTRODUCTION

Agriculture represents from ancient times a fundamental field of activity and continue to remain even today, while being an important supplier of raw material for industry and an outlet market for its production.
Therefore, the primary function of agriculture has been always to supply the population with food needed for nutrition, knowing that no branch of the economy could not and will not be able to fulfill a function as important for human existence in the future.
Agriculture, ensuring directly or indirectly to human the necessary food for nutrition, represents the crucial condition to achieving extended reproduction, of labor, the condition of the existence and development of human society.
The negative effects of agricultural reform have had a temporary negative impact on the level of crop and livestock production, but also negative effects on the upstream and downstream industries of agriculture.

MATERIAL AND METHOD

In this paper we have presented through analysis and comparison, the situation of agricultural production from Caras-Severin County. The issues involved in this scientific paper work are: land fund, crop production and animal production, the dynamic of average productions and livestock from Caras-Severin. The necessary data of the present study resulted from consultation with a vast statistical material of specialty.

RESULTS

Located in the south west of Romania, Caras-Severin County in terms of size is the third from the country with an area of 8,520 square kilometers, which represents 3.6% from the country's surface. Mountains occupy on the county's territory 65.4%, the hills have a small expansion, occupying 10.8%, 16.5% lowlands and plains are on last place, accounting 7.3% from the surface.

From Table 1 we can see the fund land structure on categories of use, where the largest share is held by pastures (45%) due to predominantly mountainous relief, followed by arable land with a percentage of 33%, meadow19%, the share lowest being held by vineyards and orchards.

Table 1. The land fund by category of use at December 31 (hectares)

Caras-Severin County	2000	2005	2010	2011	2012	2013	2014
Total area	851976	851976	851976	851976	851976	851976	851976
Agricultural area	399694	398083	396999	396928	396917	396915	396915
from which, by category of use :							
Arable	127233	127313	129661	129646	129633	129628	129628
Pastures	182861	183466	179414	179358	179349	179349	179349
Meadow	75976	74796	76393	76393	76393	76392	76392
Vineyards	1222	766	772	772	772	772	772
Orchards	12402	11742	10759	10759	10770	10774	10774

Source: Statistical Summary of Caras-Severin County – 2015

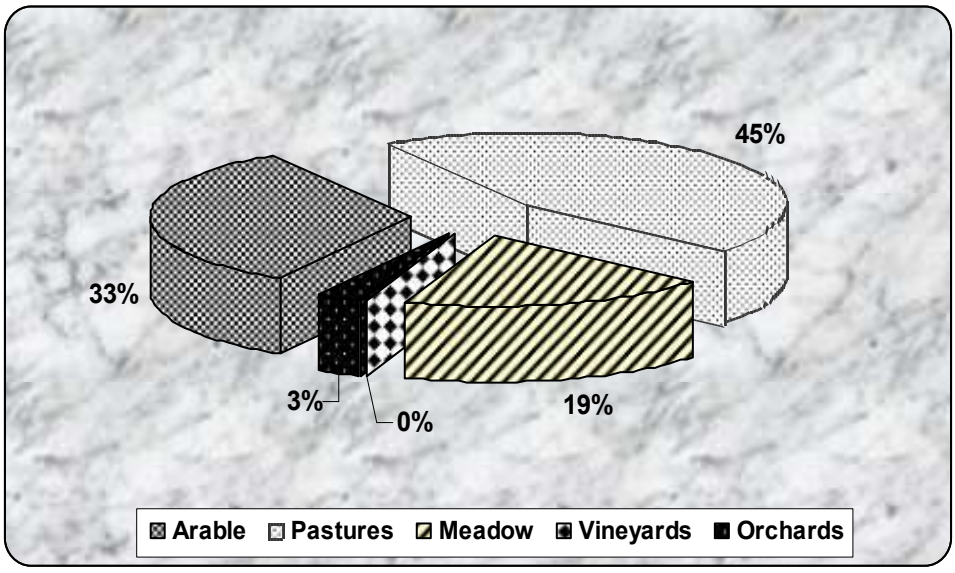

Figure 1. Agricultural area by way of use in the year 2014

Next we will analyze the evolution of agricultural production from Caras-Severin, County, where crop production predominates, followed by animal one and a very small share hold the agricultural services, as can be seen from the table below.

According to data published by the National Institute of Statistics, the structure of agriculture production value in the year 2014 has registered a significant decrease compared to the year 2013.

Table 2. Agricultural production of goods and agricultural services (thousands RON current prices)

Caras-Severin, County	Total	Vegetable	Animal	Agricultural services
2001	560139	336135	222172	1832
2005	985274	621434	360478	3362
2010	1287922	782816	504529	577
2011	1280564	812535	467739	290
2012	1317543	813405	501902	2236
2013	1407775	865188	541604	983
2014	1098699	607058	482378	9263

Source: Statistical Summary of Caras-Severin County – 2015

Compared with the year 2013, agricultural services have increased significantly in the year 2014, also it can be seen major declines in the 2014 at crop and animal production compared to the previous year.
In a healthy agrarian economy the share of vegetable production should be at the same level with the share of animal production.
Arable land, in the year 2015, was cultivated with cereals for grains on 42,227 hectares, from which 13,143 hectares to wheat and rye, and corn for grain, on 26,231 hectares.

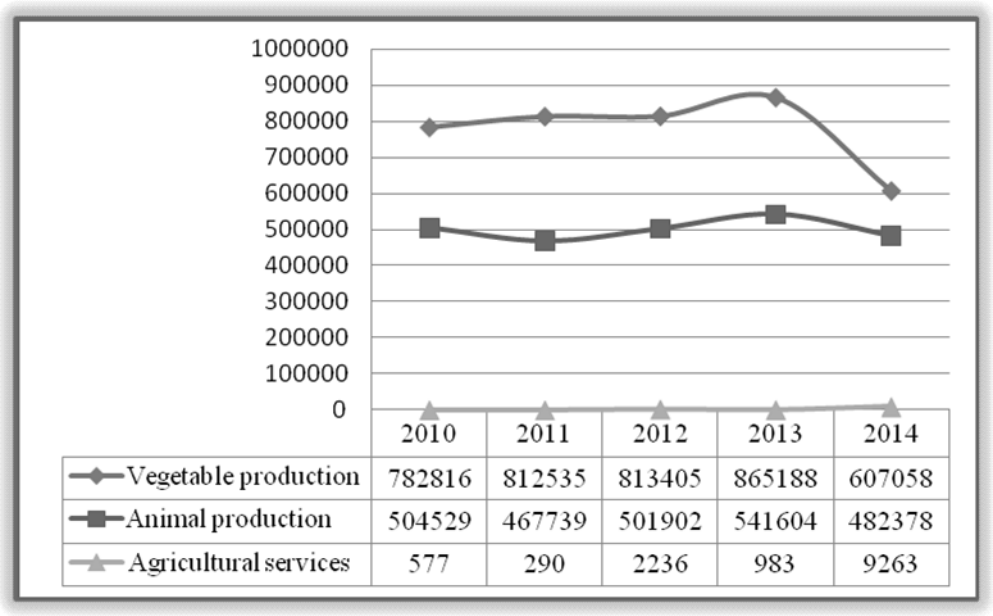

Figure 2. Evolution of agricultural production in 2010-2014 period

In the year 2015, at cereals was obtained a total production of 111,795 tones, much lower production compared to the year 2000 when total production was 160,228 tones. Compared to the year 2000, a significant increase can be observed at sunflowers, in the year 2015, where total production was 9,385 tons. At barley total production, in the year 2015 was 1,892 tones, down from total production from the year 2000, when it was 10,269 tones.
Autumn potatoes and field vegetables prevail in the population's household sector, where, in majority, are cultivated for their own consumption, but there are certain quantities routed for capitalization on the market. Cereal for grains, namely wheat and corn, represent the largest share of crops, both in population's households and agricultural trading companies.

Table 3. Agricultural vegetable production, at the main crops (tones)

Caras-Severin County	2000	2005	2010	2011	2012	2013	2014	2015
Grains	160228	220554	152623	182569	148209	155616	159170	111795
From witch:								
Wheat and rye	60971	61417	38110	33938	33184	37906	46043	36729
Barley	10269	11914	4267	2276	1414	1663	2795	1892
Corn	76684	139006	104509	139087	107718	111076	104738	68062
Sunflower	2171	4129	6863	2242	11857	11517	8559	9385
Potatoes	79549	139165	105207	91055	57530	65580	61683	47170
Vegetables	86980	48917	37825	35423	23996	29234	28945	17770
Grapes	2864	957	1202	2401	4436	4922	4222	4213
Fruits	46968	60383	31917	42977	34420	38331	35055	32450

Source: Statistical Summary of Caras-Severin County – 2015

Next, we will analyze the dynamics of average production per hectare, during 2000-2015 period, at the main crops.

Table 4. Average production per hectare, at the main crops (kg/ha)

Caras-Severin County	2000	2005	2010	2011	2012	2013	2014	2015
Wheat and rye	2978	-	2721	3107	2743	2976	3310	2795
Barley	2861	2728	2767	2690	2594	2781	2789	2889
Corn	1814	3659	3417	4235	2989	3630	3854	2595
Sunflower	915	1278	1347	1662	1654	1712	1470	1294
Potatoes	14737	19137	15345	14065	9262	11305	12307	9618
Tomatoes	13382	18189	10682	11446	7612	8096	7705	8031
Dehydrated onion	11260	11573	9552	9725	7888	8792	12181	10000
Cabbage	18776	22162	12972	14774	13466	13377	16084	15067
Lucerne	24993	25231	21192	22453	19039	19957	21589	18436
Clover	24613	20898	19977	18964	15524	17669	16851	16606

Source: Statistical Summary of Caras-Severin County – 2015

From *Table 4* above we can see that, in Caras-Severin County the average productions in the year 2015 are much lower than those from the year 2000, except corn and sunflower that have recorded increases compared to the year 2000. At wheat and rye the average production in the year 2015 was 2,795 kg/ha, down compared to the year 2000 when the average production was 2,978 kg/ha.

In *Table 5*, we present the evolution of livestock during the 2000-2015 period, in the Caras-Severin County.

Table 5. Livestock (heads)

Caras-Severin	2000	2005	2010	2011	2012	2013	2014	2015
Cattle	56718	50401	32806	32118	37105	35312	35886	36793
From witch: cows, buffaloes and heifers	33659	35558	20006	22856	24448	24577	24438	24310
Swine	41943	81575	62326	57964	60373	53691	57077	46223
From witch: covered sows	3612	4636	4294	2911	3469	3094	3065	3757
Sheep	251967	200787	210982	213411	238240	299010	292064	324630
From which: ewes and ewe	173654	172606	180677	183723	204247	251722	218300	220473
Goats	12767	14721	14728	17289	16343	21792	22647	24110
Horses	17914	14248	8762	8383	9626	8607	8762	6597
Birds	1175153	1600050	1463014	1311496	1502154	1431346	1336281	1441994
Bee	25672	37666	62043	55898	55984	57837	57611	56707
Rabbits	-	9285	6726	7112	10285	10503	10019	7019

Source: Statistical Summary of Caras-Severin County – 2015

In the analyzed period, we can see that in Caras-Severin County the number of cattle in the year 2015 is down compared to the year 2000, but up compared to the year 2014. Today, in the Caras-Severin County, the number of sheep has increased from 251,967 heads in the year 2000 to 324,630 head in the year 2015.
Herds of goats are increasing in 2015 compared with previous years, and a significant decrease can be observed at the pig herds compared to the previous year.
Next, we will analyze the total livestock production for all animals existing in the County (*Table 6*).

Table 6. Agricultural animal production

Caras-Severin County	2000	2005	2010	2011	2012	2013	2014	2015
Meat - total (tones live weight)	21109	25311	23061	20351	19827	20208	21460	25162
Beef meat (tones live weight)	2858	6001	3127	3829	3146	3505	3073	3247
Pork meat (tones live weight)	9859	7403	8940	7925	8377	7930	8831	9273
Sheep and goats meat (tones live weight)	3238	3852	2849	2684	2666	2593	2639	2801
Poultry meat (tones live weight)	5090	8035	8125	5896	5618	6168	6909	9835
Milk - total (thousand hectoliters)	943	1188	927	1052	979	944	878	854
Cow and buffalo milk (thousand hl)	823	1031	750	856	770	739	695	673
Wool total (tones)	439	370	448	443	469	516	544	548
Eggs - total (million pieces)	109	175	112	131	132	132	139	150
Honey extracted (tones)	576	1003	849	1367	1029	1629	1014	1362

Source: http://www.carasseverin.insse.ro/main.php?id=432

Analyzing animal production, we can see that the largest share represents poultry and pork meat followed by the cattle meat.
At the product extracted honey, the production increase from 576 tones in the year 2000 to 1,362 tones in the year 2015.
The total animal agricultural production is increasing in recent years, but it is obtained almost entirely in the private sector.

CONCLUSIONS

In the year 2014 crop and animal production has registered major decreases compared to the year 2013, instead agricultural services increased significantly.
Livestock production represents in the year 2015, at the level of the Caras-Severin County 44%, crop production recorded a higher percentage of 55%, the difference up to 100% being represented by agricultural services.
Because of the predominantly mountainous relief, the largest share from the agricultural area of the County is owned by pastures (45%), followed by arable land with a percentage of 33%, meadows 19% and the lowest percent is held by vineyards and orchards.

REFERENCES

BRAD I. (2007): Management şi marketing, Editura Agroprint, Timişoara
BRAD I. (2015): Managementul producţiei, Editura Eurostampa, Timişoara
Breviarul statistic al judeţului Caraş-Severin (2001 – 2015)
http://www.carasseverin.insse.ro/main.php?id=432
http://www.insse.ro/cms/sites/default/files/field/publicatii/efective_de_animale_si_productia_animala_in_anul_2015.pdf
INSTITUTUL NAŢIONAL DE STATISTICĂ (2016): Anularul Statistic al României

Review on Agriculture and Rural Development 2017 vol. 6 (1-2) ISSN 2063-4803

THE EFFECTS OF AFFORESTATION PROGRAMS IN HEVES COUNTY BETWEEN 2007 AND 2013

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ABSTRACT

The forest is one of the most complex natural ecosystems that is one of the basic living conditions of the healthy human life due to its effects on the environment. According to their functions forests can fill security, economic, social, health, tourism, and education as well as research roles.
After the end of World War I the level of forest cover decreased to 11.8% in Hungary. At this time Hungary was Europe's fourth poorest country in forest and tree. The increasing of forest cover was an important objective in each areas since then.
The location and the size of the afforested area ultimately will be appointed by the landowners' intentions. The state can support the success of the afforestation program by various devices, and promote effectively the enforcement of public interest. The New Hungary Rural Development Programme (2007-2013) envisaged the deployment of 69,000 hectares of new forest, of which 70% were implemented. Under the measure support was granted for the first afforestation of areas withdrawn from agricultural cultivation.
Despite the above average extent of forest covers in Heves County (24.5% in 2006), further opportunities were opened to increase the forest area. In afforestation terms the high priority regions includes the poor quality arable lands of feet of Mátra and Bükk mountains and the reclamation areas of Visonta open-cast lignite mine in Heves County.
During the research, we worked on secondary databases with a view to examine how regional differences there are in within Heves County in the case of location of forest areas and implemented forest plantations. On the one hand we used the data of Forestry Directorate of the National Food Chain Safety Office, on the other hand we worked up the statistics of Agricultural and Rural Development Agency about afforestation subsidies supported in the framework of New Hungary Rural Development Programme (2007-2013).
There are significant differences among the districts of Heves County regarding the extent of forest cover between upland and lowland areas. While Pétervására and Bélapátfalva districts were characterized by 61% and 59% forest cover in 2006, at the same time in Füzesabony, Heves and Hatvan districts the same value was slightly higher than 4%. In the period between 2006 and 2015 the rate of forestation increased in all districts of the County at least by 0.2 percent. The growth rate was more than one percent in Pétervására and Gyöngyös district. Therefore, a significant expanse of land that is less suitable for agricultural cultivation has given a new function.

Keywords: forests role, afforestation process**,** rural development subsidies, Heves County, regional differences

INTRODUCTION

Forest is one of the most complex natural ecosystems that, because of its environmental impact, is one of the basic living conditions of healthy human life. In addition to the conservation effects that are often regarded as natural, but with enormous economic value, those also produce raw materials and food as renewable natural resources. Its significance is not negligible in terms of livelihoods for the rural population. The purpose of the forests can be protective, economic, health-social, tourism as well as education and research (SELBY ET AL., 2005, FEJES AND RESTYÁNSZKINÉ JACZKÓ, 2013).
With the peace treaty of Trianon ending the First World War, Hungary lost the 84 percent of the forests of former country territory. The previous 26-27% forest density decreased to

11.8% in Hungary, making it the fourth poorest country in the woods in Europe. A new forestry policy has been developed in line with the radically changed social, economic and natural environment. There were two simple, clear principles that are valid until today. The first was the protection of the existing forests, improvement of their naturalness and structure. The second was to increase the country's forests by installing new forests, especially in the unwooded Great Plain (MAGYAR, 1961, GÁL AND KÁLDY, 1977).

The expansion of forestry has been a development priority in each of the last decades. Most of the afforestation was built on poor arable land or pasture that is less suitable for agricultural cultivation. So, it also played a significant role in the restructuring of agriculture (BABINYEC ET AL., 2015).

The place and size of the area to be afforested is ultimately determined by the will of the landowners. So, for a successful implementation of an afforestation programme the state has to influence it by most supportive tools, to promote public interest effectively. Most of the forests proposed for implementation are among the forests of primarily economic use. At the same time, in many places, the enforcement of public goals is determinative, such as soil and landscape protection (For example in the case of recultivation of surface mines), as well as flood and inland water protection (ZANCHI ET AL., 2007, NAABURS ET AL., 2015).

The Afforestation Programme formulated long-term (about 35-50 years) objective. The realization of which is to increase the country's forests to 27% as optimum at the time when the programme was prepared. It should be emphasized that reviewing the definition of optimal national forest level will be again timely in the near future because of fast changing environmental conditions (JANKÓ, 2013).

The New Hungary Rural Development Programme has foreseeing the installation of a new forest of 69 000 hectares for 2007-2013. On the other hand the realization was 46300 ha, which meant nearly 70% fulfilments. The willingness to afforestation was largely influenced by the following factors: loss of SAPS entitlement, increasing demand for food, initial difficulties in the support system. For forestry purposes approximately 88 billion HUF was paid and committed by the end of 2015, which is also successful in EU comparisons.

The support system cannot be considered as sources of development and profitability for farming in the case of forestry thinking over longer term due to uncertainties in EU funding after 2020. The introduction and elaboration of alternative solutions (preparation of measures) is already required, particularly as a result of mitigating the effects of climate change (EU, 2003, NAABURS ET AL., 2015).

MATERIAL AND METHOD

Our research focused on Heves County. In its territory there are significant differences in degree of forest cover and the possibilities of further afforestation by reason of varied terrain and geological conditions. In sum, mountainous areas result in higher forest cover than the national average. The dominant tree species in the mountainous and hilly areas are oaks and beech. The non-native acacia is present in the flat countryside and in the hillsides (DÖVÉNYI, 2010). About 50% of the forest areas are owned by the state and managed by a state-owned joint stock company (Egererdő). Forests are characteristic of certain parts of the county, where its share have grown in the last 20 years, but growth has lagged behind national trends. Surveying of sites for afforestation was carried out in 2006 in connection with the modification of National Spatial Plan. The most important aspect of that study was economy and environmental sensitivity. Other important influencing factors were the

soil type of the site and waterhouse maintenance. It has been established that there is still a significant area available for afforestation in the county.
To explore the subject we have chosen to process secondary databases. Our primary goal was to point out the territorial differences within Heves County with respect to forest areas, afforestation and afforestation specifically under the New Hungary Rural Development Programme (2007-2013). On the other hand, we wanted to point out the purpose of the forests and the purpose for which they have been created in recent years in regions with different abilities. On the one hand we used the data of Forestry Directorate of the National Food Chain Safety Office. On the other hand we worked up the statistics of Agricultural and Rural Development Agency about afforestation subsidies supported in the framework of environmental protection measures of NHRDP.

RESULTS

From the end of 2006 to the end of 2015 the area of Hungary covered by woodland increased from 19,928 km^2 to 20,551 km^2, which means 3.1% increase over 9 years. In Heves County, this change was somewhat lower (2.7%). At the end of the period under review, the extent of the forests of Hungary is 22.1%. Data from Heves County (25.2%) still exceed the national average, in the order of counties occupies a middle field position. In the North Hungary Region Borsod-Abaúj-Zemplén and Nógrád County's forest cover are also higher.
The districts of Heves County features very different degree of forest share. Pétervására and Bélapátfalva districts are characterized by outstanding data. The Eger and Gyöngyös districts are characterized by multi-coloured relief elements, that resulting in moderately high values. The area of the other three districts is already dominated by the lowlands, where the share of the forest is very low due to the decisive role of agriculture (*Table 1*).

Table 1. The forest cover of Heves County districts

Districts	Forest cover (%)		Area (km^2)
	2006	2015	
Bélapátfalva	58.8	59.1	180.9
Eger	36.6	37.2	602.1
Füzesabony	4.0	4.2	578.6
Gyöngyös	27.4	28.6	750.8
Hatvan	4.4	4.6	352.2
Heves	4.2	4.7	697.6
Pétervására	61.2	62.4	475.1
County total	24.5	25.2	3637.2

Source: Forestry Directorate of the National Food Chain Safety Office, 2006 & 2015.

The change in the degree of forestry is fundamentally influenced by the forest cover of districts at the beginning of the examined period. The high degree of forestry in Bélapátfalva and Pétervására districts has already been well suited to the geographic features. In absolute terms, the largest expansion of forest was observed in the Gyöngyös district by 880 ha. At the same time, the 303-hectare expansion in the Heves district meant a 10% increase in the forest covered area. In this lowland region, the unfavourable soil conditions justify the further expansion of the forest area. The expansion was 4% in the Hatvan and Füzesabony regions characterized by better soil conditions. However, the area of energy plantations may continue to grow in the future in these areas too.

The number one purpose of forests in Heves County is wood production by 47.6% proportion (*Figure 1*). The nature conservation has the second largest significance, these forests cover the 37.9% of forest area. On the steep hillside the soil protection gets more important role (10%). Many additional protection features are displayed, which are characterized by a smaller share than 1%.

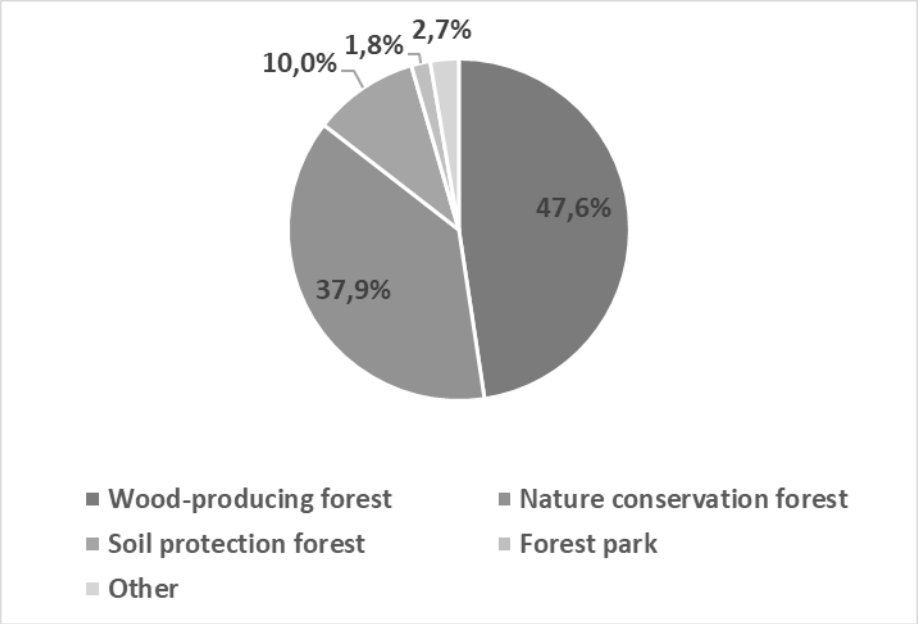

Figure 1. The distribution of forests according to their purpose in Heves County
Source: Forestry Directorate of the National Food Chain Safety Office, 2015.

The afforestation statistics are included areas designated for refurbishment and area of new installations of forest. The extension of refurbishment usually an order of magnitude greater than the new installations. The degree of afforestation has changed considerably in years of the period 2008-2015. The volume of new installations nationwide in 2008 and in 2009 exceeded 4000 hectares. However, the share of Heves County had only a little more than 1% in these years. Except for 2012, in the coming years continuously decreased the size of the areas under construction. The most affected were the Great Plain counties such as Szabolcs-Szatmár-Bereg and Bács-Kiskun. In these counties, in the case of sandy-gravel farmlands, the afforestation is justified in terms of economic and protection too. In Heves County the most significant new areas were taken off in the Heves district (124 ha), followed by Hatvan (59 ha) and Gyöngyös (45 ha) districts (*Figure 2*).
In context with afforestation of agricultural land the farmers could have submitted a grant application for grooming afforestation up to 5 years and to compensate for loss of income due to afforestation up to 15 years. Based on the amount of grants awarded, the years of 2009 (37.5%) and 2011 (31.7%) were the most significant in the county between 2007 and 2013. The districts, where forested areas represent high proportion hardly got support. The most outstanding support arrived to the Heves district. Furthermore poor quality arable lands were afforested around Eger (*Figure 3*).

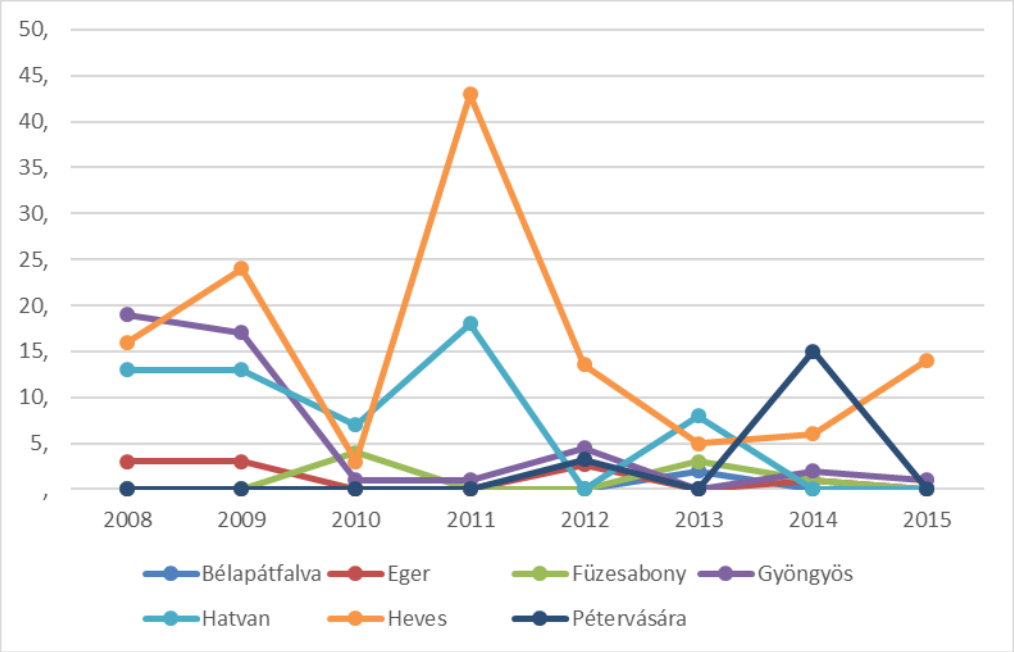

Figure 2. New afforestation (ha) between 2008 and 2015
Source: Forestry Directorate of the National Food Chain Safety Office, 2015.

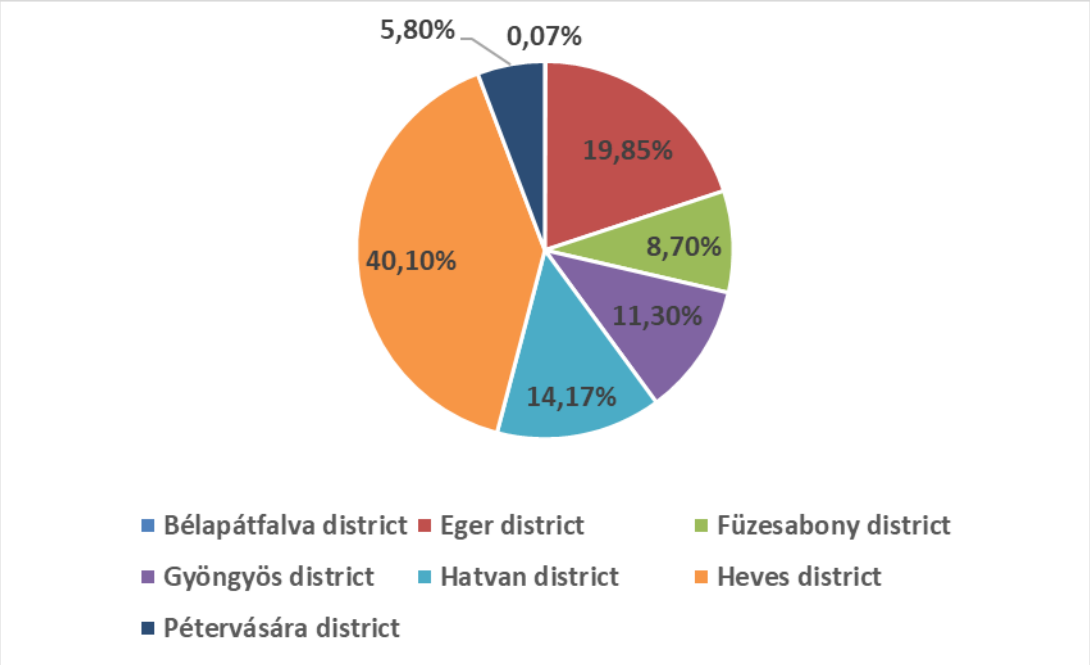

Figure 3. Subsidies for the afforestation of agricultural areas - Share of districts on the basis of subsidized amount (2007-2013)
Source: Agricultural and Rural Development Agency, 2007-2013.

CONCLUSIONS

Expansion of forest areas has been a development priority in Hungary for decades and to the present day. The afforestation is justified by several reasons, such as functional change of unproductive arable lands and meadows, better utilization of forest soils especially in mountainous areas and re-utilization of recultivation areas.

Heves County is characterized by above average forest share primarily due to mountainous areas as Mátra and Bükk. That is why there are huge differences between the northern and southern parts of the county from perspective of the location of forests. In the southern part of the county it is possible to afforest significant areas, but it will be supported by owners in case of areas with poor soil conditions and favorable subsidy conditions.
Therefore, the scheduling of afforestation of agricultural land was lagging behind in the past years. While in the county, the former territorial differences slightly decreased between mountainous and plain areas. Thus, adapting more to agro-ecological conditions and increasing income opportunities in rural areas.

REFERENCES

BABINYEC, F. ET AL. (2015): Erdővagyon és erdőgazdálkodás Magyarországon. NÉBIH Erdészeti Igazgatóság, Budapest, 4 p.
DÖVÉNYI, Z. (ED.) (2010): Magyarország kistájainak katasztere. MTA Földrajztudományi Kutatóintézet, Budapest.
EUROPEAN COMMISSION (2003): Sustainable forestry and the European Union – Initiatives of the European Commission. Luxembourg: Office for Official Publications of the European Communities, 56 p.
FEJES, L.; RESTYÁNSZKINÉ JACZKÓ, V. (2013): Az erdőgazdálkodás jellemzői. = Statisztikai Tükör 7(95): 6.
GÁL, J.; KÁLDY, J. (1977): Erdősítés. – Akadémiai Kiadó, Budapest, 640 p.
JANKÓ, F. (2013): Elfeledett viták az alföldi erdősítés és vízrendezés éghajlati hatásairól. = Földrajzi Közlemények 137(1), pp. 51-63.
MAGYAR, P. (1961): Alföldfásítás II. Akadémiai Kiadó, Budapest, 622 p.
NABUURS, G. ET AL. (2015): A new role for forests and the forest sector in the EU post-2020 climate targets. European Forest Institute, 29 p.
SELBY, A.; PETÄJISTÖ, L.; KOSKELA, T. (2005): Forests and afforestation in a rural development context: a comparative study of three regions in Finland. Working Papers of the Finnish Forest Research Institute 14: 75.
ZANCHI, G.; THIEL, D.; GREEN, T.; LINDNER, M. (2007): Afforestation in Europe. – Impact of Environmental Agreements on the CAP (Specific targeted research project), 41 p.

THE ROLE OF NATIONAL AGRICULTURAL CHAMBER'S ADVISORS IN THE LIFE OF FARMERS IN HEVES COUNTY

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ABSTRACT
The Hungarian Chamber of Agriculture (HCA) was established in the spring of 2013 as a public body. The main tasks of the HCA are strengthening and advocacy of domestic agricultural and food sector, supporting the competitiveness of Hungarian food, furthermore the consultancy and delivering fast, accurate and reliable information to farmers. After the integration of village consultants' network in 2014 the HCA established a unified support system for farmers. This system based on five pillars: information, consulting, training, project management and European Innovation Partnership. In Heves County 27 village consultants and 4 village consultant administrators perform advisory tasks coordinated by the chief village consultants. The scope of official duties performed by the network: crop estimation, data collection and reporting tasks associated with state rating, assessment of damages in agriculture etc. The advisors validate about 9500 farmers' cards year by year. In our research we examined the main features of the village consultants and farmers receiving services (such as age, gender, level of education, professional experience, current scope of activities and contacts between the two groups). We hypothesized that the age and vocational qualifications of the farmers are determining the number of services used. To answer our research questions we were performed primary data collection in Heves County. We compiled two questionnaires, one for the farmers (N=150) and one for the village consultants (N=18). To answer the remaining outstanding issues we conducted interview-based survey involving 4 experts. In the course of the survey research for the village consultants we examined theirs most important activities and ranked by the number of mention. The five most common cases were the Unified Application Administration, the validation of farmers' cards, information services in connection with former Agricultural and Rural Development Agency, monitoring data service and Chamber membership fee acknowledgment. The farmers we've asked were all familiar with the local village consultant and 88% of them known the office client's time. The 69% of the respondents more than three times visited the advisor. Based on our research the village consultants completed more than 50% of administrative tasks of farmers in the 70% of cases. Overall, the village consultant network plays an important role in the life of the farmers regardless of age or level of education.

Keywords: agricultural consultancy, advisory organizations, village consultants, information-flow, administrative tasks

INTRODUCTION

Our ever-accelerating scientific, technical and IT development, cognition and apply new results, the acceleration and continuous change of economic and market processes increasingly put emphasis on the knowledge-based economy. The effectiveness of producer and provider activities largely depends on their adaptability, which is primarily determined by the quantity and quality of the producer's knowledge (ANDERSON, 2007; SZÉKELY, 2011).

Agricultural consultancy is a service which provides training methods for farmers to develop production processes. Thus, enhancing the living standards of farmers and improving the social perception of rural life. Agricultural consultancy has two major target areas. Its economic purpose is to increase the productivity of agriculture through the

transfer of technical progress. The other is the optimal utilization of factors of production: land, labour, capital and management (KOZÁRI, 2009).
Denmark has one of the most advanced agricultural advisory systems in the world, where technical advice can support farmers through comprehensive expert systems. An expert knowledge-based approach, allows complex management of problems in farms (ANDERSEN, 2004).
New things must be delivered to farmers and they must be taught to use them. This is possible only with strong co-operation and centrally supported adequate funding. Of course this depends on the resources granted by decision-makers to perform each task. Research, vocational training and consultancy can only create a successful, competitive, responsible farmer society if they reinforce each other (VARGA AND NAGYNÉ DEMETER, 2015).
Agricultural consultancy has decisive role in that farmers get access to more EU and national sources. Because of this, education and competences of agricultural adviser is one of the direct determinants of farmers' economic success. This fact produces demand on measurement of the agricultural advisers' knowledge and presses them to increase it. The expected quality of potential consultancy services depending on the agricultural adviser's education, experience, frequency of the knowledge improvement and past outcomes of his/her work (ANDRÝSKOVÁ AND FOLTÝNEK; 2006).
For all market players in the agricultural sector and the food industry, the legislation in force since 1 August 2012 imposes mandatory membership in the new Agrarian Chamber. The Hungarian Chamber of Agriculture (HCA) was established in the spring of 2013 as a public body. The main tasks of the HCA are strengthening and advocacy of domestic agricultural and food sector, supporting the competitiveness of Hungarian food, furthermore the consultancy and delivering fast, accurate and reliable information to farmers (PAP, 2014).
The Government is based on a cooperation agreement with HCA decided about that the Agricultural Chamber can get village consultants from the Agriculture Directorates of County Government Offices. Village consultants, who have taken over, together with the 202 agricultural agrarian advisors of HCA, form a single, one-stop farmer support network within "NEGTáR" system. The purpose of the system is to find solutions to all problems of the farmers. The most important and most perceptible task of HCA is the counselling (NAGYNÉ G. PATAKI, 2014).
Those farmers who do not have an online query interface with the necessary technical conditions. They can still directly contact their village consultants with their questions personally, by phone or email. Village consultants and rapporteurs are given continuous training to cover the details and provide practical information about access to resources (RESZKETŐ, 2015).

MATERIAL AND METHOD

We chose Heves County as the target area for our research, where, due to the varied terrain conditions, all sectors of Hungarian agriculture can be found. However, due to soil conditions, the yield of most crops is lower than the national average.
In Heves County 27 village consultants and 4 village consultant administrators perform advisory tasks coordinated by the chief village consultants. Currently there are 5 centres (Eger, Hatvan, Heves, Detk, Füzesabony) waiting for our customers. Furthermore, in Gyöngyös there is an office open every day of the week, where the presidential cabinet is located. The network has a number of official tasks, such as data collection and data supply about yield estimation, status qualification; survey of agricultural damage events; cross-

compliance verification and control of uncultivated areas. We highlight that they are responsible for issuing and validating the original farmer's ID cards, which is a new chamber service since 2014. In the study region, the consultants carry out the validation of 9500 primary producers' certificates from year to year.

To answer our research questions, we were performed primary data collection in Heves County. Two questionnaires were prepared for our research, one questionnaire for farmers and one for the village consultants. The first questionnaire was filled by 150 farmers. In this questionnaire we asked the age, gender, and educational level of the respondents. Then we were curious about the following: Do you know the village consultant responsible for your settlement? Are you aware of opening hours? Did you visit the office for administration? We got responses about number of administrations per year, what kind of cases they ask for help and how many percent of the administrative burdens can they help?

In the second questionnaire following the query of the basic data of village consultants (N=18), we found the following information: number of unique applications submitted in 2015; number of farmer's ID card administration in 2015; responsible area of the village consultants; peculiarities of regular contact with the farmers and name of the most common cases.

To answer the remaining outstanding issues, we conducted interview-based survey involving 4 experts, who have comprehensive information both from official and farmers' point of view. The information they shared we incorporated into our conclusions.

RESULTS

In the first part of our empirical research we asked 150 farmers in Heves County. Based on the age distribution of farmers, it can be concluded that over 40 years are overweight, so the aging of the farmers' society is also characteristic of the county. 39% of the surveyed farmers were women, which was also close to our preliminary assumptions.

The highest level of education in the target group is quite good. *Figure 7* shows that the proportion of people with higher education in the target group is 32% and those with secondary education are 61%. This can be explained by the fact that, in addition to carrying out agricultural activities, administrations and tenders require higher qualifications.

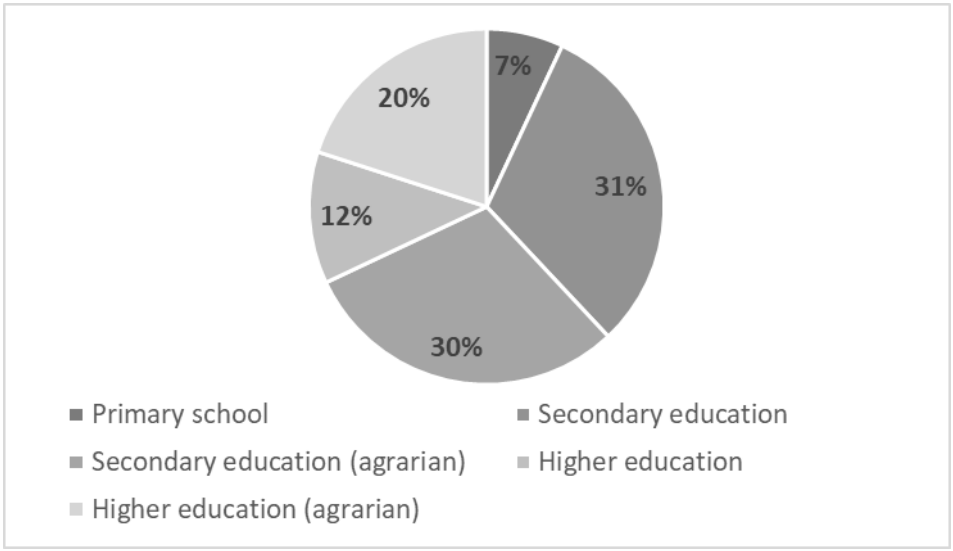

Figure 1. Percentage distribution of farmers' qualifications

Source: Based on questionnaire survey, 2016.

Analysing the results obtained, it can be concluded that the proportion of persons with specialization qualifications is also high. 49% of those with secondary education and 62% of those with higher education qualifications have a specialty agricultural qualification. In the case of non-agricultural graduates, it is likely that they did not care about agriculture in their younger years, they did not see any possibility of living in this sector. These clients are forced to acquire secondary vocational qualifications if they wish to receive subsidies in the future. Furthermore, changes in the land law necessitate the existence of professional qualifications, unless they have been farming for 3 years.

It is comforting to know that 100% of the farmers interviewed are familiar with the village consultant in their village. 88% of the respondents are aware of the customer's reception time of the staff of the Hungarian Chamber of Agriculture. 69% of the farmers visit their village consultant more than three times a year. Only 7 percent of the respondents are those who only visit the chamber labourers once a year. These numbers also support the fact that farmers are in great need of administrative assistance.

One of the main questions of our survey was which are the most common cases in which farmers ask village consultants for help? 90% of the respondents nominated the validation of the Farmers' ID and 75% the area-based support administration. Landlord and land acquisition information is least sought by farmers, which may also mean that most of the producers are aware of this information (*Figure 2*).

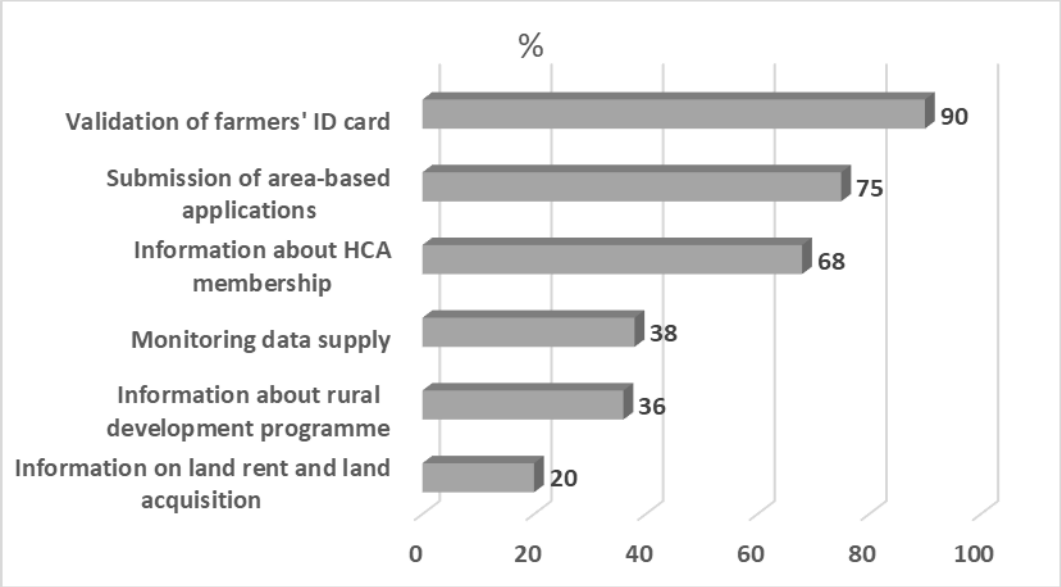

Figure 2. Percentage distribution of type of cases identified by farmers

Source: Based on questionnaire survey, 2016.

The final question of our questionnaire asked how many percent of administrative burdens are taken away by village consultants from farmers' shoulders. 70% of the respondents said that the amount of administration that their village consultant helps them is above the 50%. During our research, we did not encounter a producer who did not ask for help carrying out administrative tasks (*Figure 3*).

Another questionnaire of our research was questioned among 27 village consultants of Heves County. 18 of them answered our questions. The average age of village consultants is 45 years. The majority of respondents belong to the young age group and are innovative in performing the tasks. Our target group contains a person who has been a village consultant for a year, but we've met someone who has been working in this position for 22 years. The surveyed village consultants have been working on average for 11 years in this profession.

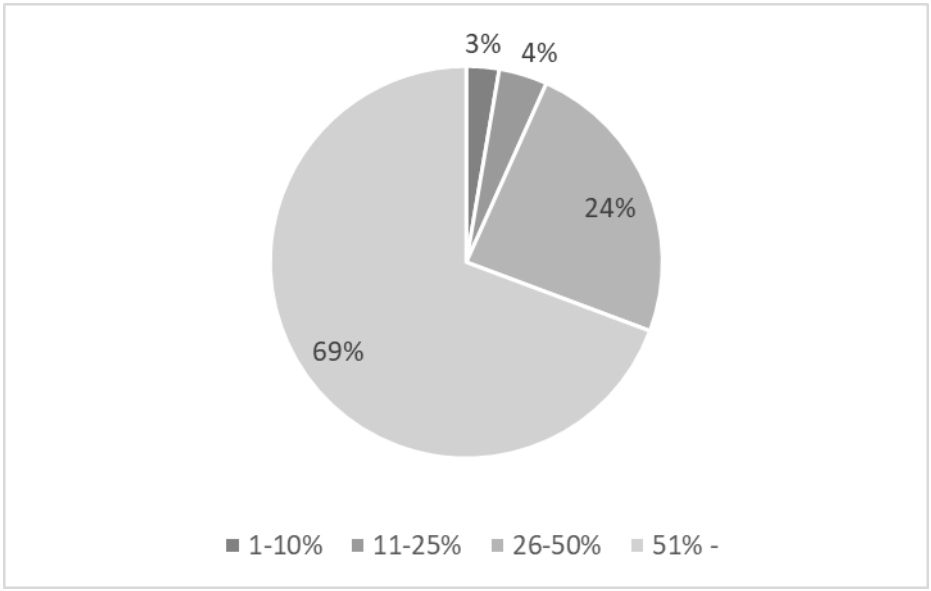

Figure 3. The percentage of administrative burdens that the village consultant helps the respondents

Source: Based on questionnaire survey, 2016.

As mentioned above, one of the most important tasks of village economists is to submit single applications. *Figure 4* shows that 6057 single applications were submitted to the Agriculture and Rural Development Office in Heves County in 2015. The 4002 applications submitted by village consultants represent 66%. The submission of uniform applications for 2015 meant a more complex, new interface for village consultants. Despite the complexity of the new system, county farmers were served and their applications were submitted. As a result of the statutory change that area-based subsidies are deserved for more than one hectare area, the number of county applicants decreased by 800 compared to the previous year. Among the respondents, we can meet with a village consultant who has submitted 122 Area-Based Grant Applications in the year 2015, but also who submitted 320 applications.

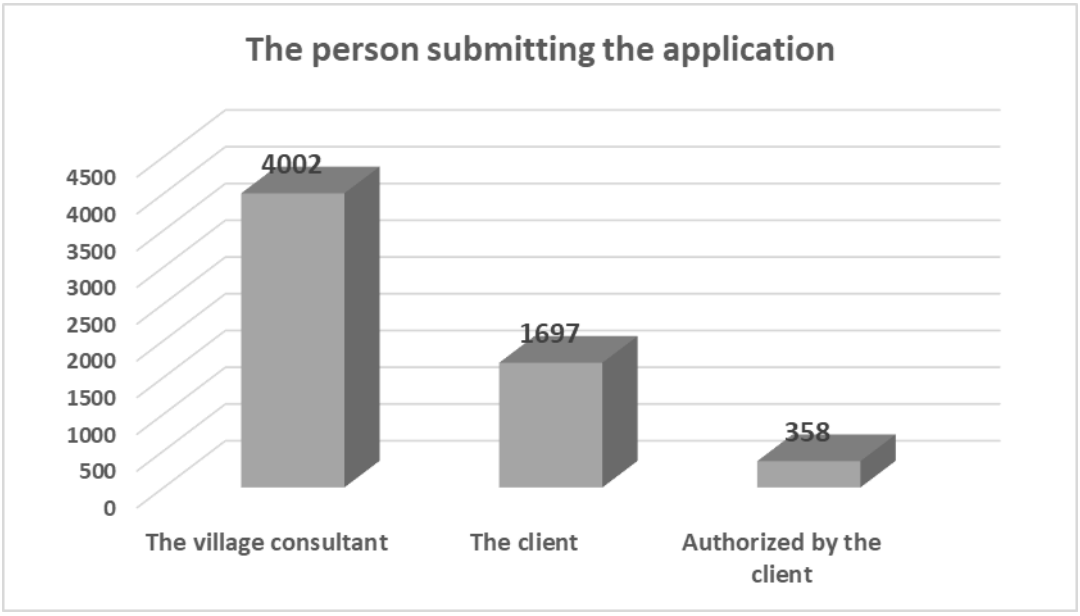

Figure 4. Number of single application in 2015

Source: Edited by the authors, 2016.

The surveyed village consultants are responsible for 2-6 settlements, where customer service offices are reserved and they have reception times. The number of farmers they regularly keep in contact with is between 60 and 730 people.

CONCLUSIONS

Through our research, we pointed out the importance of the activity of village consultant working in the Heves County. The employee of the HCA participating in research submitted 3475 single applications and completed 6664 farmers' ID cards in 2015. These activities were manifested in a large number by each village consultant. In addition, they carried out several special and novel activities in administrative, tender and professional fields.

The farmers questioned also said that village consultants are taking considerable burdens from their shoulders. The hypothesis we made before the survey did not prove that farmers with lower qualifications use the services of village consultants more widely. During the processing of questionnaires and interviews it became apparent, that farmers with higher qualifications also needed the services of village economists because there are cases in which they can only assist. Many people take advantage of their services due to lack of time and to avoid inaccuracy. In addition to the day-to-day activity of the village consultants, they are constantly receiving the necessary training and information.

During the interviews, we found that young highly qualified farmers already use all sources of information (e.g. village consultant, internet, farmers' forum etc.), but in their work many times the administration takes a back seat. In many cases, farmers are notified if they have a mandatory deadline or there are information about new tendering opportunities.

REFERENCES

ANDERSEN, H.J. (2004): Different personal skills and competencies which local agricultural advisers can use to concrete change in management procedures: A case-study of Danish dairy farmers and advisers. The Journal of Agricultural Education and Extension 10(4): 151-162.

ANDERSON, J.R. (2007): Agricultural Advisory Services. - Background Paper for the World Development Report 2008, 44 p.

ANDRÝSKOVÁ, J., FOLTÝNEK, T. (2006): Evaluation of the agricultural advisers' knowledge and assessment of the entrance expectations coefficient. = AGRIC. ECON. – CZECH 52(9): 401-411.

KOZÁRI J. (ED.) (2009): Mezőgazdasági Szaktanácsadás. Szaktudás Kiadó Ház, Budapest, 152 p.

NAGYNÉ G. PATAKI Á. (2014), Ha tanácsra van szüksége, akkor irány a Kamara! – NAKlap 2014. január

PAP, E. (2014): Húszéves a falugazdász-hálózat. = Magyar Mezőgazdaság, 2014/24: 8-9.

RESZKETŐ, T. (ED.) (2015): Vidékfejleszési program kézikönyv. NAK, Budapest, 86 p.

SZÉKELY E. (2011): A magyarországi mezőgazdasági szaktanácsadás intézményi jellemzői. = Gazdálkodás 55(5): 502-511.

VARGA T.; NAGYNÉ DEMETER, D. (2015): Szaktanácsadás vagy tanácsadás? - Egy felmérés eredményei. = Acta Carolus Robertus 5(1): 117-128.

Review on Agriculture and Rural Development 2017 vol. 6 (1-2) ISSN 2063-4803

EYE-TRACKING ANALYSIS OF LEAFY VEGETABLES

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ABSTRACT
There is a great supply of leafy vegetables on the market; hence capturing consumer's attention (and decision) is critically important. Several scientific publications deal with consumer choices and the newest technology to capture consumer attention is eye-tracking. Eye-trackers are commonly used in Western Europe and Asia also, where it is an important and widely-used tool during product developments and the creation of marketing strategies. In Hungary, there are only a few publications about eye-tracking applications in vegetable growing and food industry. In our research, photographs about sorrel, lamb lettuce, spinach, leaf lettuce and dandelion leafs were analysed by eye-tracking technology and the eye movements of the participants during their decision making process of leafy vegetables were captured and evaluated. The eye-tracking analyses were carried out in the Sensory Laboratory of the Faculty of Food Sciences of Szent István University, using a Tobii X2-60 eye-tracker and Tobii Studio (version 3.0.5, Tobii Technology AB, Sweden) software. We aimed to answer the following research questions: Are there any connections between the eye movements of participants and their decisions? What amount of visual attention can be registered during the decision making process? Furthermore, the following metrics were measured and evaluated: fixation durations on the leafy vegetables, number of returns to products, pathways of visual attention, time until the final decision making and motivation of their final decisions. Measurement of the subconscious consumer decision making processes is way easier using eye-trackers compared to the traditional questionnaire-based methods, because it is hard or impossible to control our eye movements. Eye-tracking can be used successfully for understanding the expectations and decisions of the consumers.

Keywords: eye-tracking, leafy vegetables, value-based segmentation; eye movements

INTRODUCTION

Acceptance of minimally processed vegetables has been increased in the last few years (ZHOU ET AL., 2004). Wide range of consumers are looking for that products, primarily those who have family with young children and higher education (RAGAERT ET AL., 2004). Psychologic factors also play role in the gazing behaviour not just gender or socio-demographic factors (ARES ET AL., 2014). To understand consumer's gazing behaviour, itis also valuable to analyse the consumer's personal values. For identification of people's behaviour and motives, marketers typically use the so-called value based segmentation technique (VERAIN ET AL., 2016). Appearance is one of the key factors in food quality. Visual attention plays an important role in food choices (GERE ET AL., 2016), because the first impression about the food and their quality takes through visual appearance, which very often is the only attribute that could help in the decision making during the purchase (CARDELLO, 1998; KEAST, 2010). Attributes related to appearance are important for consumers but these are the most susceptible to objective measures (TZIA ET AL., 2016).
Eye-tracking is widely used for capturing the eye movements of participants while they are completing different tasks (*e.g.:* choice tasks, free viewing tasks, *etc.*). Several eye-tracking parameters could be measured that can be used to characterize the gazing pattern of the individuals (HOLMQVIST ET AL., 2011).

MATERIAL AND METHOD

This study was a slice of a bigger experiment work, and six alternatives were presented to the participants. Eye-tracking tests were performed in the Sensory Laboratory of the Faculty of Food Science of Szent István University, based on previous eye-tracking studies (GERE, 2016). For the recording and processing of the eye movement data of participants, a Tobii X2-60 static eye-tracker and the Tobii Studio (version 3.0.5, Tobii Technology AB, Sweden) data processing software were used. Images ensured the visual stimuli on a monitor with a 1280x1024 pixel resolution. Participants of the eye-tracking study were recruited from the Buda Campus of Szent István University. Participants were seated in front of a monitor connected to the eye-tracker, meanwhile their eyes were 60 to 65 cm from the monitor. They were asked to place their dominant hand on the mouse and not to move their heads and their positions. Calibrations were carried out before each test, then after the successful calibration, a text containing instructions related to the test appeared on the monitor, in which the process of the test was described in detail. Between the images, there was a black "+" sign, the so-called fixation cross, on the centre of the monitor. The purpose of the fixation cross was to standardize the starting point of attention. This was showed for 3 sec and followed by selection tasks. After reaching the decision, the participant clicked on the left mouse button to bring up the previously invisible mouse pointer on the display, and then they could click on the selected product. 163 people participated in the study and data recording was successful for everyone, but only 140 results were perfectly fitted for the picture that contains six component, these were included in the data analysis.

During the evaluation of the eye-tracking measurement results, work was based on the following definitions (GERE ET AL., 2016): 1. Fixation duration: the average length of fixations on a given area of interest (AoI). 2. Fixation counts: the number of fixations for a specific product that shows how many times the given product was viewed by the participant. 3. Dwell duration: the average length of glimpses at different product images during gaze wandering between two fixations, when no information is absorbed. 4. Dwell count: the total number of visits for a given area of interest (AoI).

Before the test, participants were asked to rate importance of the values listed in the first column of *Table 1*. The labels of the applied 5-point scale were the following: not important at all, less important, moderately important, important, really important.

In this study cluster analysis was used for characterisation and margin of homogenous clusters, that method makes relative homogenous clusters (MALHOTRA, 2005). One advantage is for cluster analysis is that the thinking of the researcher could not affects the segmentation, because method uses distance matrix between data points. During the cluster analysis, hierarchical analysis was done using Euclidean distance and Ward's agglomeration method. Due to the hierarchical nature of the method, the cases were agglomerated step-by-step. The benefit of hierarchical methods is that they try to make almost equal sized clusters and a dendrogram helps to visualize the agglomeration schedule and the structure of the created clusters. XL-Stat software (Addinsoft, 28 West 27th Street, Suite 503, New York, NY 10001, USA) was used for the analyses.

RESULTS

Figure 1 shows a heat map of the fixation durations (from green to red colour means the duration of fixation and red corresponds to the most watched product) of all participants. It shows that leaf lettuce received the most visual attention, after that come rocket salad, and

sorrel. The green spot on the centre of the picture, refers to the previously watched „+" sign.

Figure 1. Heat map of the photographs about sorrel, rocket salad, lamb lettuce, spinach, leaf lettuce and dandelion leaves

Based on the value structure results of homogenous groups (clusters), were classified by:

- characterisation of clusters based on their values,
- characterisation of clusters based on eye movement parameters,
- characterisation of clusters based on duration of decision making.

Based on the structures of the values, results with one exception (enjoyable life), every attribute based on eye movement parameters showed significant differences (α=0.05) according to the applied Kruskal-Wallis test. Based on the results, participants were sorted into 4 different clusters based on their values (Ward's method, Euclidean distance). Each cluster was characterised by their mean, dispersion and Dunn's pairwise comparison with Bonferroni correction, which gives letter markings for homogenous and heterogeneous groups. That gives an opportunity to analyse clusters about significant differences between parameters of each cluster. On the top of *Table 1* the values of attributes are showed, meanwhile below those values are showed parameters about eye movements.

In the **first cluster** the 'conservative self-realized' individuals are located, because they live a family centred life with conservative custom values, meanwhile true friendship, self-realization, personal and financial security and education plays also important roles in their lifestyle. The least important attribute for them is alternative/not traditional living style. They were the most precious, because the counts of fixations and dwells, and duration of fixations and dwells were also the highest and the longest during the tests.

Members of **second cluster** are the 'life enjoyed independents', who prefer the following values the most: true friendship, personal and financial security, enjoyable life, personal freedom/ independence, although value of traditions was the least important for them. The eye movement parameters showed, that they fixated shorter and more often on the pictures.

In the **third cluster** we identified the 'financial-social-educated' participants. Most important values were for them: personal and financial security, true friendship and education. Interesting that every attributes got higher importance than 'moderately important' value. Eye movement parameters showed that dwell counts were moderated

compared to other clusters, therefore fixation count and fixation and dwell durations were really low and short such as in case of the fourth cluster.

The fourth cluster contained 'immediate environment centred indifferentists' who actually just interested in family life, true friendship and enjoyable life and other attributes are moderately important for them. Their eye movement parameters tell that they needed the shortest and lowest fixations and dwells (*Table 1*). Based on these, they watched the pictures sloppily.

Table 1. Characterization of clusters by values (the first five values of each cluster are highlighted (darkest is the most important)

Attributes	Cluster1	Cluster2	Cluster3	Cluster4	Kruskal -Wallis
True friendship	4.77±0.42b	4.78±0.52b	4.80±0.40b	4.18±0.65a	**0.0003**
Family life	4.70±0.53b	4.36±0.62a	4.69±0.61b	4.56±0.51ab	**0.0136**
Personal and financial security	4.40±0.62b	4.51±0.55b	4.80±0.40c	3.68±0.94a	**< 0.0001**
Enjoyable life	4.29±0.73ab	4.39±0.62ab	4.50±0.64b	4.06±0.68a	0.1969
Self–realization	4.66±0.57c	4.34±0.61b	4.57±0.64bc	3.62±0.61a	**< 0.0001**
Social origin	4.45±0.62bc	4.12±0.84ab	4.65±0.56c	3.75±1.23a	**0.0059**
Personal freedom/ independence	3.98±0.81a	4.39±0.58b	4.69±0.54b	3.50±1.09a	**< 0.0001**
Education	4.12±0.73b	4.29±0.71b	4.73±0.45c	3.31±0.70a	**< 0.0001**
Comfortable life	3.61±0.70a	4.21±0.65b	4.42±0.70b	3.56±1.03a	**< 0.0001**
Having a lot of free time	3.43±0.68a	4.07±0.81bc	4.30±0.73c	3.81±0.75b	**< 0.0001**
Health consciousness	4.01±0.61b	3.87±0.67b	4.46±0.58c	3.25±0.57a	**< 0.0001**
Good appearance	3.75±0.73b	3.92±0.68b	4.38±0.63c	3.25±0.77a	**< 0.0001**
Economical living	3.31±0.80a	3.75±0.88b	4.26±0.72c	3.37±1.08ab	**0.0001**
Environment and energy conscious life	3.77±0.65b	3.70±0.87b	4.38±0.57c	2.81±0.65a	**< 0.0001**
High living standard	3.40±0.77b	3.92±0.84c	4.15±0.78c	2.75±0.68a	**< 0.0001**
Caring about culture and arts	3.77±0.73b	3.02±0.79a	4.38±0.63c	2.93±0.68a	**< 0.0001**
Social recognition	3.49±0.86b	3.17±0.86ab	4.19±0.84c	2.56±1.03a	**< 0.0001**
Working for the community	3.56±0.65b	3.14±0.85a	3.92±0.74b	2.75±0.85a	**< 0.0001**
Traditions	3.38±0.79b	2.36±0.62a	4.11±0.90c	3.25±0.68b	**< 0.0001**
Alternative/not traditional living style	3.03±1.08b	2.51±1.02a	3.15±1.28b	2.18±0.83a	**0.0028**
Fixation duration	5.37±2.30b	4.40±2.05a	3.74±1.52a	3.54±1.71a	**0,002**
Dwell duration	6.18±3.22b	5.08±2.43ab	4.42±2.64a	3.87±1.46a	**0,0112**
Fixation count	21.85±4.15b	21.24±3.80b	15.11±2.95a	17.26±3.46a	**< 0.0001**
Dwell count	14.73±3.81c	13.53±4.13bc	12.53±2.84ab	11.06±2.67a	**0,0027**

Decision times of the clusters created based on the values were compared by Survival Analysis. The curves' show similar characteristics. First cluster 'conservative self-realized' needed the longest time to make the final decision, that cluster was significantly different (α=0.05) from the others.
Participants of third cluster, 'financial-social-educated' and the forth cluster 'immediate environment centred indifferentist' were the fastest decision makers. These two clusters were not significantly different.
Members of the second cluster, ('life enjoyed independents') made their decisions significantly faster compared to participants from the first cluster ('conservative self-realized'); meanwhile they were slower than people in the fourth cluster ('immediate environment centred indifferentist') (*Table 2, Figure 2*).

TABLE 2. Cluster value segmentation (Test statistic showed in the upper-right half-matrix, p-values showed in the lower-left half-matrix). Significant differences are marked with bold.

	Cluster1	Cluster2	Cluster3	Cluster4
Cluster1	–	**2.459524**	**3.313691**	**3.727084**
Cluster2	**0.01391**	–	1.756353	**2.370899**
Cluster3	**0.00092**	0.07903	–	0.660465
Cluster4	**0.00019**	**0.01774**	0.50896	–

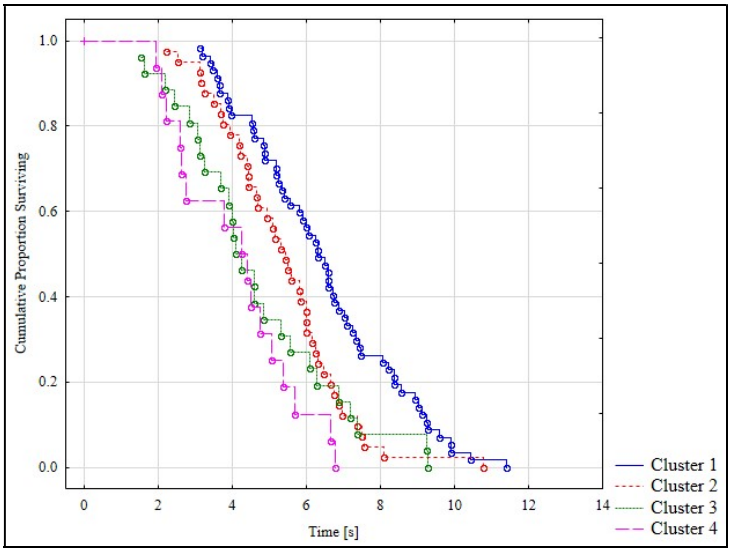

Figure 2. The obtained Kaplan-Meier surviving plot is generated by plotting the time on the *x*-axis and the proportion of those participants who made their decisions on the *y*-axis

CONCLUSIONS

In this study, leafy vegetables were evaluated which are used as component in salad mixes very often. Participants answered questions which were used to conduct value-based segmentation. The novelty of the experiment was that values and eye movement parameters were evaluated using the combination of different statistical methods (cluster analysis, survival analysis, Kruskal-Wallis and Dunn's pairwise comparison).
Decision times of the clusters created based on the values were used together with eye movement parameters for classification (based on their values, eye movement parameters,

duration of decision making). Values describing the clusters were in accordance with eye movement parameters and with the time needed to make the final decison. Results are useful for package optimisation and selection of mixes contains for target groups (clusters) specially.

ACKNOWLEDGEMENTS

The authors would like to thank the participants for their help.

 Supported by the ÚNKP-16-4 New National Excellence Program of the Ministry of Human Capacities.

REFERENCES

ARES, G., MAWAD, F., GIMÉNEZ, A., MAICHE, A. (2014): Influence of rational and intuitive thinking styles on food choice: Preliminary evidence from an eye-tracking study with yogurt labels. Food Quality and Preference 31: 28–37.

CARDELLO, A.V. (1998): Perception of food quality (Chapter 1). In: TAUB, I. A., SINGH, R. P. (eds). Food storage stability. CRC Press, Taylor & Francis Group, Boca Raton, FL, USA. pp. 1-32.

GERE, A. (2016): Módszerfejlesztés a preferencia-térképezésben. Szent István Egyetem, doktori értekezés (http://www.doktori.hu/index.php?menuid=193&vid=15760) pp. 68-71.

GERE, A., DANNER, L., NINO, de A., KOVÁCS, S., DÜRRSCHMID, K., SIPOS, L. (2016): Visual attention accompanying food decision process: an alternative approach to choose the best models. Food Quality and Preference 51: 1–7.

HOLMQVIST, K., NYSTRÖOM, M., ANDERSSON, R., van de WEIJER, J. (2011): Eye tracking. A comprehensive guide to methods and measures. Oxford: Oxford University Press.

KEAST, R. S. J. (2010): Food quality perception (Chapter 3). In: ORTEGA-RIVAS E. (ed.). Processing effects on safety and quality of foods (Contemporary food Engineering Series, D.W. Sun series editor), CRC Press, Taylor & Francis Group, Boca Raton, FL, USA. pp. 68–83.

KOVÁCS E., GERE A., SZÉKELY D., KÓKAI Z., SIPOS L. (2016): Eye-tracking tests in consumer perception of food. Journal of Food Investigation 62(2): 1062–1068.

RAGAERT, P., VERBEKE, W., DEVLIEGHERE, F., DEBEVERE, J. (2004): Consumer perception and choice of minimally processed vegetables and packaged fruits. Food Quality and Preference 15(3): 259–270.

TZIA, C., GIANNOU, V., LIGNOU, S., LEBESI, D. (2016): Sensory evaluation of foods (Chapter 2). In: T. VARZAKAS and C. TZIA (eds). Handbook of Food Processing: Food Safety, Quality, and Manufacturing Processes. CRC Press, Taylor & Francis Group, Boca Raton, FL, USA. pp. 41–71.

VERAIN, M. C. D., SIJTSEMA, S. J., ANTONIDES, G. (2016): Consumer segmentation based on food-category attribute importance: The relation with healthiness and sustainability perceptions. Food Quality and Preference 48: 99–106.

ZHOU, T., HARRISON, A. D., MCKELLAR, R., YOUNG, J. C., ODUMERU, J., PIYASENA P., LU, X., MERCER, D. G., KARR, S. (2004): Determination of acceptability and shelf life of ready-to-use lettuce by digital image analysis. Food Research International 37: 875–881.

Review on Agriculture and Rural Development 2017 vol. 6 (1-2) ISSN 2063-4803

APPLICATIONS OF SRD-METHOD IN HORTICULTURAL AND FOOD SCIENCES

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ABSTRACT
Scientific questions in horticultural and food sciences can be classified by their complexity. On the one hand, the effect of an attribute is evaluated without changing other factors. The other type is when the effect of the interactions of different treatments is analysed. In some cases, it would be necessary to use new approaches. How can we evaluate cultivars, methods, proceedings, treatments, etc. meanwhile using all parameters at the same time? Sum of Ranking Differences (SRD) is an alternative statistical method, implemented by Héberger (2010). Validation and the software implementation was done by HÉBERGER AND KOLLÁR-HUNEK (2011). Cultivars, methods, procedures, treatments, etc. can be compared successfully with SRD-method. Several international publications proved the relevancy of the methodology. In this study, SRD-method is introduced, as well as those researches, which conducted in horticultural and food sciences. Based on these, new fields of application are suggested.

Keywords: sum of ranking differences (SRD), rank order, nonparametric tests, multicriteria optimization

INTRODUCTION

In the horticultural and food sciences, the subject of the research could be analysed from one or more aspects in accordance to the experimental design. These analyses are primarily used for the comparison of substances in question, which solutions are based on parametric statistical methods and post-hoc tests, which can only be used after the criteria tests.
The most commonly used statistical tests (t-test, analysis of variance (ANOVA)) require normally distributed variables. In the case of normal distribution, the mean, the median and the mode are in the same place, ergo they are equal (Gaussian curve). In many cases, skewness and kurtosis could be present, therefore the average, the median and the mode relation can be deceiving. If the value of kurtosis and/or skewness exceeds ±1, then the distribution cannot be considered as normal. For values of skewness and kurtosis, and the quotient of their standard error do not allowed to exceed ±1.96 (TABACHNICK AND FIDELL, 2003, 2007). In addition to the graphical test methods, the most commonly used tests are Kolmogorov–Szmirnov and Shapiro-Wilk tests to test the normal distribution. For normality testing, the null hypothesis is that the distribution of the examined variable does not differ from the normal distribution. If the conditions of normality are not fulfilled we can choose from several possible solutions: 1. transforming the data, which converts them into normal distribution (square root, logarithmic, 1/x, Box-cox etc. transformations), 2. use of nonparametric tests, which are equivalent to the parametric ones (e.g. Two-sample t test→Mann-Whitney U-test, one-way analysis of variance→Kruskal-Wallis test).

It is generally accepted that nonparametric tests have less statistical power than parametric ones. In order to be able to make a decision about the conditions of normality, at least 10 parallel measurements are required. In the practice of horticultural and food sciences this requirement is usually not fulfilled. In case of low number of cases, the normality requirements can be harmed. As a result, the requirements of parametric tests are not fulfilled, so the less efficient, but the distribution independent nonparametric methods should be chosen, which are not sensitive to damage the normality conditions and distribution of the samples variety (ANDRIĆ AND HÉBERGER, 2015).
In the horticultural and food sciences, typically one factor effect is tested and all other factors remain unchanged. The advantage of this practice is that we can clearly identify that factor which is responsible for the change, but we do not have any knowledge about what outcome would be gained whether more or all factors would be taken into account. Therefore, a new approach is needed that takes into account all the measured features together, creating more reliable results. Accordingly, due to the new approach, multivariate nonparametric statistical methods come into prominence.

MATERIAL AND METHOD

The principle of 'Sum of Ranking Differences, SRD' was created by HÉBERGER (2010), its validation and software implementation was realized by HÉBERGER AND KOLLÁR-HUNEK (2011), which enabled the separation of different methods and procedures based on the principle of the method. The presentation of the methodology is based on their research results. Objects (statistical cases, compounds/components) are sorted in rows, the variables (models, methods) are arranged in the input matrix columns, will be aligned in increasing order based on the results of the objects. Then the absolute values of different standards (reference) and individual ranking differences will be calculated and summarized for each variable/model. Different standard (reference) values can be: average (AVE), maximum (Max), minimum (Min), or scanned value (Read). Thus, the difference between the rankings, the SRD values are calculated for each variable/model (*Figure 1*).
Calculations are be performed in Microsoft Office Excel 2007 macro, which is written in Visual Basic programming language (freely available here): http://aki.ttk.mta.hu/srd/. The method is based on that the value is even more similar to the evaluated attribute how closer is to the reference/standard SRD-value. The SRD-method validation was conducted with permutation tests by using 3 million simulated compare ranks with random numbers (CRRN).

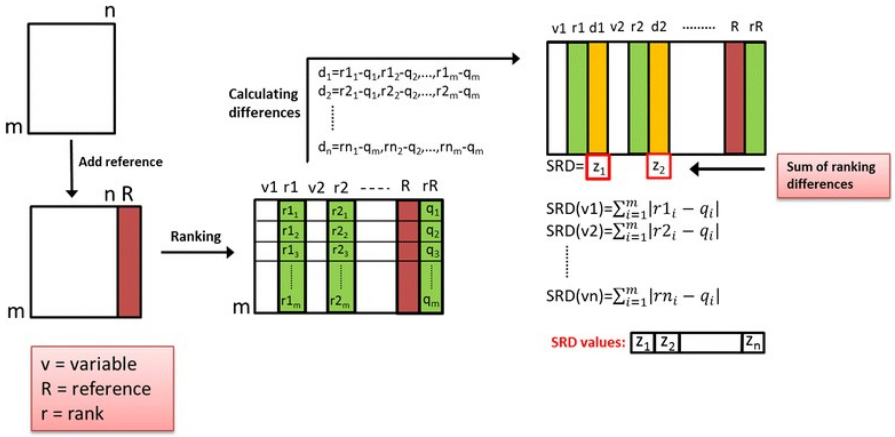

Figure 3. Calculation of SRD values
Source: BAJUSZ ET AL. (2015)

In the case of a low number of cases a recursive algorithm based on the theoretical distribution is calculated, with which the distribution function can be converged. In the case of a higher case number (n>8), the normal distribution, as a good approximation, can be used for the description of the theoretical (random) SRD distribution function. The normal approximation of the theoretical distribution of SRD values was introduced by HÉBERGER and KOLLÁR-HUNEK (2011), as well as the improved version, which handles ties present in a dataset. With the increase of n, the approximation of normal distribution gives better results (KOLLÁR-HUNEK and HÉBERGER, 2013). The results are rank order (SRD values). When visualizing the results, the normal approximation values are read on the right abscissa, while the SRD% values are shown on the left abscissa and on the ordinate. These SRD values are usually normalized to enable the comparison of different SRD calculations.

Leave-one-out (LOO) cross-validation process is a possibility for the variability of the SRD values, where one row is always removed from the dataset and a separate SRD is run on each of them. In the nonparametric way, Wilcoxon matched pairs test is a process for the pairwise comparison of the SRD values generated from the cross-validation process.

RESULTS

Applications

Several publications show that Sum of Ranking Difference has justification in horticultural and food sciences. Applications of SRD method with or without the combination of analysis of variance were successfully used for the assessment of methods and models (selection of chromatographic columns) (HÉBERGER, 2010), for the investigation of sensory panel performance (SIPOS ET AL., 2011), for the comparison of multiclass classifiers (SZÖLLŐSI ET AL., 2012), for industrial preference mapping (LOSÓ ET AL., 2012), for the comparison of chemometric methods (FRAGKAKI ET AL., 2012), for the evaluation of the results of collaborative laboratory trials (ŠKRBIĆ ET AL., 2013), for evaluation of single-cell gel electrophoresis (HÉBERGER ET AL., 2014), for chromatographic analysis of lipophilicity (ANDRIĆ AND HÉBERGER, 2015) for to choose the best models to predict consumer choices during eye-tracking studies (GERE ET AL., 2016).

Newest publications showed that SRD could be a good option for research analysis from one or more aspects.

CSAMBALIK ET AL. (2017) identified a combination of methodologies, that could be validated to be able to do multidimensional evaluation for the investigation necessary of phytonutrient content in tomato landraces. Based on the phytonutrient (FRAP, DPPH, sugar-acid ratio, dry matter content, vitamin C content, total phenolic content, lycopene content) content of landraces (rows) and commercial tomato varieties (columns) they made a ranking with SRD-method, where the maximum phytonutrient values were used for reference column. They also used leave-one-out (LOO) cross-validation process, where one row (phytonutrient) was always removed from the dataset and after that Wilcoxon matched pairs test was run. The results of the Wilcoxon matched pairs test showed that landraces have the most favourable phytonutrient value. According to their results, three groups have been identified; Bugac and Veresegyháza were the closest to the reference landrace that had the highest phytonutrient values. These were followed by Máriapócs, Kozárd, Soltvadkert, Gyöngyös, Cigánd, Jánoshalma landraces, and the Hellfrucht variety. Nagykáta and Cegléd landraces were the last group. Bugac did not shows significant difference from Veresegyház (p<0.05). Nagykáta and Cegléd landraces were not significantly different from Máriapócs and Hellfrucht.

SIPOS ET AL. (2017) assessed 11 cherry tomatoes from commercial trade. Lycopene content was measured as well as the FRAP-, DPPH-, CUPRAC-, ABTS- and TPC-assay following extraction by either water, ethanol or methanol. SRD was used to rank the antioxidant-capacity assay and extraction eluent combinations. Different assays are capable of the most efficient differentiation between the samples by the application of the different extraction eluents during the sample preparation. As reference, the theoretical best method extraction combination was defined (in this case the ideal maximum value represents the idealistic antioxidant capacity assay extraction combination). The CUPRAC-EtOH and the CUPRAC-supernatant assay combinations were the most effective among the tested methods. This method is a relatively rarely applied compared to DPPH or FRAP, which proved to be far less capable of distinguishing cherry tomato samples.

GERE ET AL. (2017) worked on an approach, that uses a bunch of multivariate statistical methods to identify the key JAR variables for product development. Evaluation of the connection between JAR and hedonic data using multiple methods. The authors also selected the best evaluation method(s) for JAR analysis.

ASTM MNL-63 consisted of the evaluations of five products using six JAR variables along with one overall liking variable. During the ranking of attributes the maximum values of the rows were used for reference column. After the normalization and calculations, they identified that the following attributes had the most important impact on liking (p<0.05): Flavour–, Stickiness+ and Color–.

Different Penalty analysis evaluation methods were used in the rows in SRD after normalization of the input data matrix (square root transformation of the original attributes). The reference column contained the maximum values of the rows during SRD-method. Result showed GPCM and OLS were the closest to the zero point; other methods located over the five percentiles line; these had no significant evidence to their rank.

SIPOS ET AL. (2016) evaluated eight different *Ocimum basilicum* L. gene bank accessions with SRD-method and also applied LOO, Wilcoxon and Sign tests. SRD was run based on vitamin C, DPPH, total phenolic content, FRAP, total flavonoid, salvigenin, nevadensin, essential oil contents. For the reference column the maximum values of the attributes were used. Results showed that 'M. Grünes' was the best variety, followed by 'A-1'with 'Dark Opal'. The weakest groups were 'Arvada', 'Genovese', 'Lengyel', 'Piros' and Rit-Sat' genotypes which were no significantly different from each other.

BOROS ET AL. (2016) ranked lettuce types with SRD-method. Crisphead, Butterhead, Romaine, Green and Red leaf types of lettuce were evaluated about their bioactive compounds (iron, folate, vitamin C, β-carotene, lutein and total phenolic content). For the SRD-method, bioactive compounds were used in rows and columns contained lettuce types. Based on the results, Romaine and Red leaf lettuce were the best, these were followed by Butterhead and Green leaf types. The weakest was the Crisphead type.

RÁCZ ET AL. (2015) compared and evaluated (ranked and grouped) antioxidant capacity assays of berries and sour cherries. They determined which assay(s) can be used with the least error, if only one technique can be chosen. The average was chosen as reference for all of the datasets. In addition, SRD could rank the different antioxidant activity methods for berry and sour cherry samples. For both datasets FRAP and TPC were the closest to reference, while ACW and ACL were the fairest. (In the case of berries the rank was FRAP, TRSC, TPC, DPPH, ACL, ACW. In the case of sour cherry the rank was TPC, FRAP and TEAC, ACL, ACW.) FRAP and TPC were recommended to substitute all the other antioxidant capacity methods for both datasets.

DISCUSSION

In this study, we showed the opportunities of SRD-method in horticulture and food sciences. At this moment, the software which capable and incapable to handle repetitions is freely available here: http://aki.ttk.mta.hu/srd/. Also, there are input and output files presenting the methodology.
Simultaneous evaluation of different attributes gives the importance of weighting because every attribute has dissimilar relevancy. Calculation with the weight is not solved neither in theoretic way nor in software programming level. It gives more difficulties that maximum 40 rows could be taken to the input matrix if necessary the permutation tests by using 3.000.000 simulated compare ranks with random numbers (CRRN), but without this validation the software is possible to handle 1500 rows for simple ranking. In that case, it could be more powerful to use different validation method. The SRD program with ties has relative long calculation time caused by the simulation of a 3 million *n*-dimensional random vector set, that is indispensable to each *n*-dimensional IRC vector (Index vectors of Reference Column), given to an input matrix, where n>8. KOLLÁR-HUNEK AND HÉBERGER (2015) suggested the optimization of the probability distributions for the faster run. At this moment the base value of the ranking can handle 2 or 3 decimal places. If the original data were not measured in the same scale, then it is necessary to do data transformation, meanwhile the method is sensitive for this. Usually logarithmic or root transformation give good results.
In point of fact Sum of Ranking Differences (SRD) method is useful for every scientific question where it is necessary the ranking and simultaneously available several attributes (with equal weight). Expedience to use both validation method (3 million size *n*-dimensional random vector set curve, leave-one-out (LOO) cross-validation process and nonparametric Wilcoxon matched pairs test).

ACKNOWLEDGEMENTS

 Supported by the ÚNKP-16-4 and ÚNKP-17-4 New National Excellence Program of the Ministry of Human Capacities.

REFERENCES

ANDRIĆ, F., HÉBERGER, K. (2015): Chromatographic and computational assessment of lipophilicity using sum of ranking differences and generalized pair-correlation. Journal of Chromatography A 1380(6): 130–138.
BAJUSZ, D. RÁCZ, A., HÉBERGER, K. (2015): Why is Tanimoto index an appropriate choice for fingerprint-based similarity calculations? Journal of Cheminformatics 7(20): 1–13.
BOROS, I. F., KAPPEL, N., GERE, A., SIPOS, L. (2016): Comparison of different lettuce types (*Lactuca sativa* L.) based on their bioactive compounds. Proceedings of 1st International Conference on Biosystems and Food Engineering. pp. 1–8.
CSAMBALIK L., DIVÉKY-ERTSEY, A., PUSZTAI, P., BOROS, F., ORBÁN, CS., KOVÁCS, S., GERE, A., SIPOS, L. (2017): Multi-perspective evaluation of phytonutrients - case study on tomato landraces for fresh consumption. Journal of Functional Foods 33: 211–216.
FRAGKAKI, A., FARMAKI, E., THOMAIDIS, N. S., GEORGAKOPOULOS, C. (2012): Comparison of multiple linear regression, partial least squares and artificial neural networks for

prediction of gas chromatographic relative retention times of trimethylsilylated anabolic androgenic steroids. Journal of Chromatography A 1256(21): 232–239.
GERE, A., DANNER, L., ANTONI, N., KOVÁCS, S., DÜRRSCHMID, K., SIPOS, L. (2016): Visual attention accompanying food decision process: an alternative approach to choose the best model. Food Quality and Preference 51: 1–7.
GERE, A., SIPOS, L., KOVÁCS, S., KÓKAI, Z., HÉBERGER, K. (2017). Which just-about-right feature should be changed if evaluations deviate? A case study using sum of ranking differences. Chemometrics and Intelligent Laboratory Systems 161: 130–135.
HÉBERGER, K. (2010): Sum of ranking differences compares methods or models fairly. TrAC Trends in Analytical Chemistry 29(1): 101–109.
HÉBERGER, K., KOLAREVIĆ, S., KRAČUN-KOLAREVIĆ, M., SUNJOG, K., GAČIĆ, Z., KLJAJIĆ, Z., MITRIĆ, M., VUKOVIĆ-GAČIĆ, B. (2014): Evaluation of single-cell gel electrophoresis data: Combination of variance analysis with sum of ranking differences. Mutation Research-Genetic Toxicology And Environmental Mutagenesis 771: 15–22.
HÉBERGER, K., KOLLÁR-HUNEK, K. (2011): Sum of ranking differences for method discrimination and its validation: comparison of ranks with random numbers. Journal of Chemometrics 25(4): 151–158.
KOLLÁR-HUNEK, K., HÉBERGER, K. (2013): Method and model comparison by sum of ranking differences in cases of repeated observations (ties). Chemometrics and Intelligent Laboratory Systems 127: 139–146.
KOLLÁR-HUNEK, K., HÉBERGER, K. (2015): Classification of SRD-with-ties probability distributions. Conferentia Cemometrica 2015. Budapest, MTA TTK 2015. 09. 13-16. Research Centre for Natural Sciences Chemometrics and Chemoinformatics Working Group of the Hungarian Academy of Sciences.
LOSÓ, V., TÓTH, A., GERE, A., HESZBERGER, J., SZÉKELY, G., KÓKAI, Z., SIPOS, L. (2012): Methodology problems of the industrial preference mapping. Acta Alim. 41: 109–119.
RÁCZ, A., PAPP, N., BALOGH, E.†, FODOR, M., HÉBERGER, K. (2015): Comparison of antioxidant capacity assays with chemometric methods. Analytical Methods 7(10): 4216–4224.
SIPOS, L., BERNHARDT, B., GERE, A., KOMÁROMI, B., ORBÁN, CS., BERNÁTH, J., SZABÓ, K. (2016): Multicriteria optimization to evaluate the performance of *Ocimum basilicum* L. varieties. Industrial Crops and Products 94: 514–519.
SIPOS, L., KOVÁCS, Z., SZÖLLŐSI, D., KÓKAI, Z., DALMADI, I., FEKETE, A. (2011): Comparison of novel sensory panel performance evaluation techniques with e-nose analysis integration. Journal of Chemometrics 25(5): 275–286.
SIPOS, L., ORBÁN, CS., BÁLINT, I., CSAMBALIK, L., DIVÉKY-ERTSEY, A., GERE, A. (2017): Colour parameters as indicators of lycopene and antioxidant activity traits of cherry tomatoes (*Solanum lycopersicum* L.) European Food Research and Technology 243(5): 1–11.
ŠKRBIĆ, B., HÉBERGER, K., DJURIŠIĆ-MLADENOVIĆ, N. (2013): Comparison of multianalyte proficiency test results by sum of ranking differences, principal component analysis, and hierarchical cluster analysis. Anal. Bioanal. Chem. 405: 8363–8375.
SZÖLLŐSI, D., DÉNES, D. L., FIRTHA, F., KOVÁCS, Z., FEKETE, A. (2012): Comparison of six multiclass classifiers by the use of different classification performance indicators. Journal of Chemometrics 26(3-4): 76–84.
TABACHNICK, B. G., & FIDELL, L. S. (2003): Preparatory data analyses. Paper presented at the annual meeting of the Western Psychological Association, Vancouver, BC, Canada.
TABACHNICK, B. G., & FIDELL, L. S. (2007): Using multivariate statistics (5th ed.) Boston, MA: Allyn & Bacon.

Review on Agriculture and Rural Development 2017 vol. 6 (1-2) ISSN 2063-4803

FACTORS INFLUENCING FUNCTIONAL FOOD AND FOOD SUPPLEMENT CONSUMPTION

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ABSTRACT
Functional foods and food supplements are two of the major classes of nutraceuticals or food-related products that have health benefits, such as improving health and prevention and treatment of disease. The aim of this present study is to introduce the main factors influencing functional food consumptions as well as food supplement consumption, searching for the answers to the following research questions: (1) What factors affect functional food and food supplement consumption and to what extent? (2) What is the most authentic source of information in customers' decision making? Results of secondary and primary researches suggest that the most important factors in decision making are: experience in earlier consumption, nutrients, quality and price. Food supplements are complex products and therefore, it is difficult for consumers to check the quality of these products at point of purchase; thus food-safety is a major issue for customers when buying food supplements. It can also be concluded that the availability and reliability of the source of information can greatly determine customer's decision making. The most authentic source of information according to customers' opinion were the following: health care professionals, sales staff and health-related articles. These variables should be taken into account for marketers and businesses when considering product development or improving communication on nutritional and health benefits of functional food and food supplements.

Keywords: food industry, decision making, source of information, food-safety

INTRODUCTION

Many areas of the food industry (food safety, food quality, food security, food logistics, etc.) around the globe are in the focus of multiple actors, and are also of high importance for the European Union. For example, it's a natural requirement of food not to have a detrimental effect on health, but to support health instead. Mapping all these areas requires scientific perspectives and related research results (BARTHA AND NÉMETH, 2016).
The food industry is also one of the most important branches of the national economies in the European Union, playing a central role for the processing of agricultural raw materials and food supply. In this industry, innovations are recognized as an important instrument for companies belonging to the food industry in order to stand out from competitors and to satisfy consumer expectations (BIGLIARDI ET AL., 2013). Markets for this category show intense competition and in order to survive, companies must carefully plan new product processes. This competitive atmosphere suffers from a lack of information and understanding of consumer attitudes and behaviour and this could lead to poor market acceptance (VERBEKE, 2005). This study presents an overview of global markets of functional food and the situation of food supplements. Moreover, the purpose of this article is to identify the basic motivators of consumers of functional food, throughout the example of consumer habits of food supplements users in Hungary.

The global market situation of functional food

Lifestyle diseases are rapidly increasing in frequency, in both developed and developing

countries due to industrialization and faulty dietary habits. (KRISHNAJA AND UKKURU, 2016).

Numerous studies in literature showed that there is an increasing popularity in the use of functional food and dietary supplements as well. DOYON AND LABRECQUE (2008) say that "a functional food is, or appears similar to, a conventional food. It is part of a standard diet and is consumed on a regular basis, in normal quantities. It has proven health benefits that reduce the risk of specific chronic diseases or beneficially affect target functions beyond its basic nutritional functions." According to CHEN (2011), a functional food is a food that "affect[s] beneficially one or more target functions of the body, beyond adequate nutritional effects, in a way that is relevant to either an improved state of health and well-being and/or reduction of risk of disease." The definition of food supplements according to the EUROPEAN COMMISSION Regulations (2002) is: "as an addition to a normal diet, food business operators, market food supplements, which are concentrated sources of nutrients (or other substances) with a nutritional or physiological effect. Such food supplements can be marketed in "dose" form, such as pills, tablets, capsules, liquids in measured doses, etc."

The market of functional foods is growing rapidly and is highly dynamic. As shown in *Figure 1*, Asia is a vast territory, led by China and Japan. The population in Japan is aging faster than in any other part of the world. Senior consumers are more interested in maintaining a healthy lifestyle, willing to spend money on products with warranty sure to be beneficial. We should also mention the Pacific Islands, which contribute to the growth of the market, despite the small percentages.

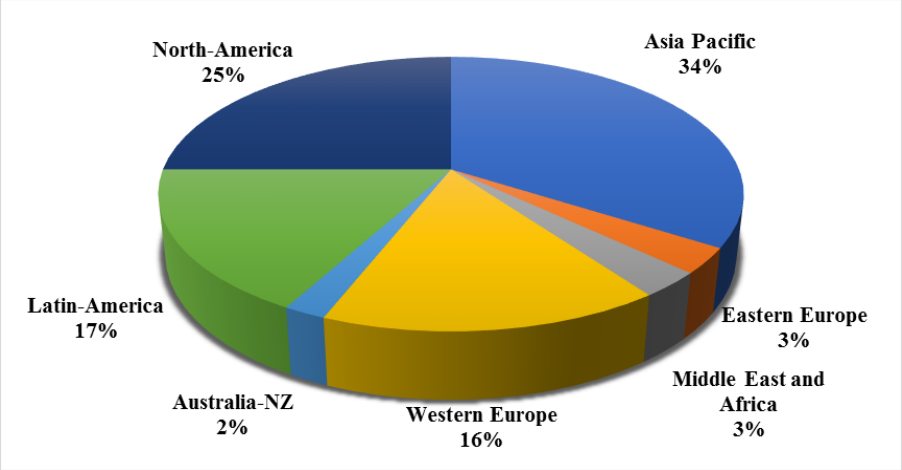

Figure 1. Percentage breakdown of total revenue worldwide
Source: EUROMONITOR, (2013) cited by VINCENTINI ET AL. (2016)

Despite being the second largest market, North America sees a decidedly unbalanced trend from 2007-08 to 2008-09 according to VINCENTINI ET AL. (2016), whereas, Latin America is considered a promising region. Finally, in the Middle East and Africa the economic and social context make the growth of these markets difficult and unstable. The demand for functional food in Europe varies considerably from country to country. Western Europe has a wide range of functional foods. The variety of functional foods is able to meet the specific needs of particular groups of consumers. This has led to the development of a profitable market, which has been relatively stable over time, with a 16% of total revenue worldwide. The leaders are: UK with 20% of total revenues, followed by Germany (14%) and France (13%) of total revenues. Spain and Italy account for 12 and 11% of total revenues respectively. In Eastern Europe, the functional food market accounts for approximately 3% of total revenues overall. Russia alone constitutes 51% of total revenues

for functional foods, followed by Poland (17%) and the Czech Republic (9%). On the other hand, for most of the other countries in Eastern Europe, the marketing of functional foods has begun or is even non-existent. So, the market of functional foods in the East European region is very fragmented and in need of a better organization and an adequate promotion in order to foster development (VINCENTINI ET AL., 2016). As for Hungary, due to Hungarians' strengthening health-consciousness, vitamins and food supplements experienced increasing demand in the last few years. According to EUROMONITOR (2016), functional foods are also present on the market and perform well, most Hungarians still place greater trust in the effectiveness of pills and tablets. The prospects of Hungarian functional food market, however, are favourable: vitamins and food supplements are expected to benefit from Hungarians' rising health-consciousness and self-medication. Moreover, stable economic conditions will contribute to growth of the category.

Influencing factors in consumption

Some studies have found a number of variables affecting the consumption and purchasing habits of consumers. These are the degree of healthiness of their diet the existence of special needs related to problems of health and nutrition information on the label (ANNUNZIATA AND PASCALE, 2009). The agro-food companies have responded to this new trend and have developed a growing variety of new products with instructions and pictures related to health: functional foods. It is not easy to understand the level of knowledge gained by the consumer in respect of these foods and the reasons behind the decision to buy/not to buy. Some studies have identified the main factors that influence the consumer's decision to purchase. Authors divide these factors into three groups: consumer characteristics (gender, age, education, lifestyle), purchasing situation and product characteristics (quality, price, safety) (BRÖRING, 2010). Other studies distinguish among sensory attributes of food (e.g. aroma or texture), physiological (e.g. hunger or appetite) and psychological factors (e.g. mood, beliefs or attitudes) (STEIN AND RODRÍGUEZCEREZO, 2008). Another study has suggested the main trends that drive the success of functional foods, such as: age, sex, education and demographic changes (URALA AND LAHTEENMAKI, 2007), the containment of health care costs (MILNER, 2000), media, access to more information, nutrition labeling (KOTILAINEN ET AL., 2006). Health claims are key factors for the development of the functional food market. They play a central role in driving purchase decisions, and help consumers make more informed food choices (ANNUNZIATA AND VECCHIO, 2012). There have been studies conducted in the past that has showed a significant difference in attitudes between male, females and different age groups (CARRILLO ET AL., 2013).

In my study I wish to map the situation in Hungary and investigate the factors influencing Hungarian consumers in food supplement consumption.

MATERIAL AND METHOD

A study was undertaken in a sample of 104 adults in Hungary (*Table 1*). Sociodemographic and health-related data were collected online using a standardized questionnaire. Questionnaire included food supplement and health-related topics. The limitations of this study have been mostly related to time and resource limitations. Respondents with a higher degree of education are overrepresented. IBM SPSS Statistics 24 was used for data processing. In the analysis, descriptive statistics and non-parametric methods were applied. Differences were considered statistically significant when $p<0.05$.

Table 1. Sample characteristics

Sample characteristics	Total	%
n	104	
Gender (n=103)		
Male	50	49
Female	53	51
Age (years) (n=104)		
18-29	8	7.7
30-39	28	26.9
40-49	28	26.9
50-59	25	24
60 +	15	14.4
Education (n=104)		
Higher education	51	49
High school	33	31.7
Secondary education without GCSE	16	15.4
Other education (primary)	2	1.9

Source: Own calculation (2016)

RESULTS

In my research, I studied, inter alia, the impact of gender on the judgement of food supplements and alternative health care food products. I conducted the non-parametric method by Mann-Whitney U test. (*Table 2*) From this data, it can be concluded that the willingness of the use of alternative health care products among women was statistically significantly higher than among men ($U=790$, $Z=-3.804$, $p<0.0001$).

Table 2. Ranks

	Gender	N	Mean Rank	Sum of Ranks
Q1. I willingly use alternative (non-medicine) health care food products.	Man	50	41.30	2065.00
	Woman	53	62.09	3291.00
	Total	103		

Source: Own calculation (2016)

Besides drawing a picture about the driving motivators of functional food consumption based on secondary sources, in my primary research I also examined the influencing factors in food supplement consumption in Hungary and I found that the driving motivator is the earlier experience in consumption, followed by quality and price (*Figure 2*). Safety was also a main factor according to customers' judgement. Advertisements and manufacturer were also important for customers, but at a less extent.

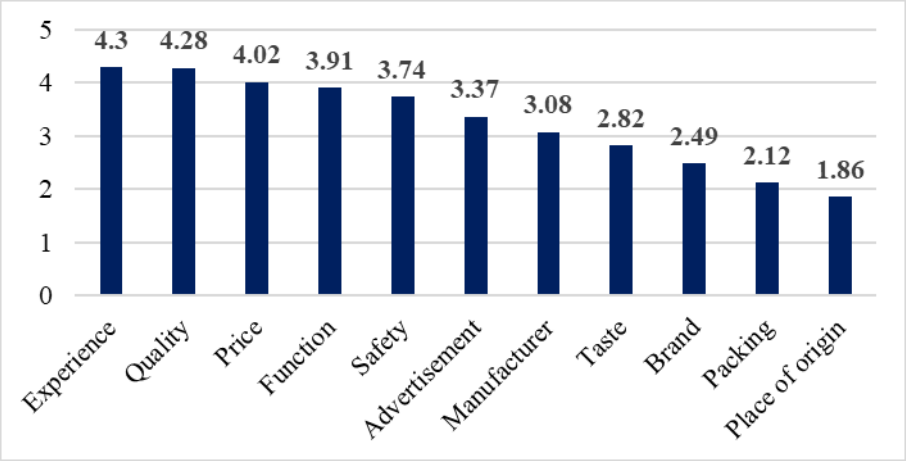

Figure 2. Driving factors in food supplement consumption
Source: Own research (2014)

Figure 3 shows the most important sources of information in decision making process. Respondents believe that the opinion of healthcare professionals (doctors, pharmacists) is the most authentic information, followed by the advices of sales persons, and then articles and TV/radio programs related to the topic. Customers obtain information from acquaintances moderately. Examining the question on basis of gender, 94% of women and 56% of men listen to health care professionals completely. Whereas, 44% of men and only 3% of women accept recommendation mostly from doctor's and pharmacist's.

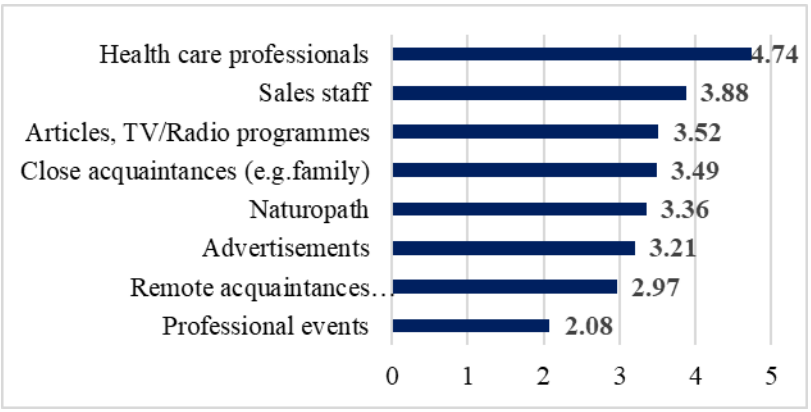

Figure 3. Source of information in decision making process
Source: Own research (2014)

CONCLUSIONS

As it is described in the chapter of Introduction, international trends showing a significant increase in the sector can also be seen in Hungary, albeit to a much less notable degree. In my study, I mapped the basic factors influencing food supplement consumption in Hungary. The consumption of functional food is influenced by several factors. Findings of my survey in Hungary show great similarity with the results of recent international literature (URALA AND LAHTEENMAKI, 2007; STEIN AND RODRÍGUEZCEREZO, 2008; BRÖRING, 2010; ANNUNZIATA AND VECCHIO, 2012; CARRILLO ET AL., 2013; KRAUS, 2015). Many of the authors emphasize the importance of labelling and a health claim as a key factor in consumption. Communication has a great impact on consumers' knowledge and attitudes. The authentic source of information is also necessary for customers in decision

making process. The results of secondary and primary research indicate that better labelling information and related knowledge perceived by consumers have critical effects on consumer trust in food supplements, which in turn will influence their attitudes and intentions to purchase food supplements. Learning about the basic motivating factors in consumption may be helpful in the development of functional food products and promotion programmes.

REFERENCES

ANNUNZIATA, A., VECCHIO, R. (2012): Consumer perception of functional foods: A conjoint analysis with probiotics. Food Quality and Preference 28: 348.

BARTHA, A., NÉMETH, N. (2016): Situation of functional food and dietary supplements according to the aspects of food industry and food safety. Future Scientists for Sustainable Development Conference - 3rd VUA YOUTH Scientific Session, Gödöllő, 2016.

BIGLIARDI, B., GALATI, F. (2013): Innovation trends in the food industry - The case of functional foods. Trends in Food science & Technology 31(2): 118-129. doi: 10.1016/j.tifs.2013.03.006

BRÖRING, S. (2010): Consumer Awareness of Health Ingredients - Walking the Fine Line of Innovation Between Food and Drugs. CHEManager Europe 11-12, 5.

CARILLO, E., PRADO-GASCÓ, V., FISMAN, S., VARELA, P. (2013): Why buying functional foods? Understanding spending behavior through structural equation modelling. Food Research International 50(1): 361-368.

CHEN, M (2011): The joint moderating effect of health consciousness and healthy lifestyle on consumers' willingness to use functional foods in Taiwa., Appetite, 57 (1): 253-262

DOYON, M., LABRECQUE J. (2008): Functional foods: a conceptual definition. British Food Journal 110 (11): 1133-1149.

REGULATION (EC) No. 2002/46/EC of the European Parliament and of the Council of 10 June 2002.

EUROMONITOR (2016): Vitamins and dietary supplements in Hungary. http://www.euromonitor.com/vitamins-and-dietary-supplements-in-hungary/report downloaded: 10/04/2017

KRAUS, A. (2015): Factors influencing the decisions to buy and consume functional food. British Food Journal 117(6): 1622-1636, doi: 10.1108/BFJ-08-2014-0301

KRISHNAJA, U., UKKURU, P. M. (2016): Development and quality assessment of Functional Food Supplement (FFS) for the management of lifestyle diseases. Asian Journal Dairy & Food Research 35(3): 227-233.

MILNER, J.A. (2000): Functional foods: the US perspective. American Journal of Clinical Nutrition 71:1654S.

STEIN, A.J., RODRÍGUEZ-CEREZO, E. (2008): Functional food in the European Union. Scientific and Technical Research Series. Joint Research Centre – Institute for Prospective Technological Studies.

URALA, N., LAHTEENMAKI, L. (2007): Consumers changing attitudes towards functional foods. Food Quality and Preference 18: 1-12.

VERBEKE, W. (2005): Consumer Acceptance of Functional Foods: Socio-Demographic, Cognitive and Attitudinal Determinants. Food Quality and Preference 16: 45-47.

VICENTINI, A., LIBERATORE, R., MASTROCOLA, D. (2016): Functional food: Trends and development of the global market. Italian Journal of Food Science 28: 338-352.

Review on Agriculture and Rural Development 2017 vol. 6 (1-2) ISSN 2063-4803

CHEMICAL AND MICROBIOLOGICAL CHARACTERISTIC OF SILOMAIZE ENSILED WITH SOME LACTIC ACID BACTERIA STRAINS

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ABSTRACT
The object of the trial was to study the effect of some lactic acid bacteria strains on the chemical composition, energy- and metabolisable protein (MP) content, microbiological characteristics and in-silo weight and dry matter losses of whole crop maize silages.
The whole plant maize raw material was 32% DM, in soft cheddar stage of grain ripeness. It was ensiled in 4.2 litre capacity glass micro-size silos in 5 replicates /each treatment and stored on constant 25 °C room temperature on day 95. The average packing desity was 211kg DM/m^3
The applied treatments: 1. Untreated control, 2. *Enterococcus faecium* 100.000 CFU/g FM, 3. *Lactobacillus plantarum* 50.000 CFU/g + *Enterococcus faecium* 50.000 CFU/g, 4. *Lactococcus lactis* 100.000 CFU/g, 5. *Lactobacillus plantarum* 50.000 CFU + *Lactococcus lactis* 50.000 CFU/g, 6. *Lactobacillus plantarum* 100.000 CFU
The main experiences are the following:
- Chemical composition of whole crop maize silages treated by lactic acid bacteria strains are significantly differed from the control in some cases on P 5% level but the nutritive value (energy and MP content) of silages did not change significantly compare to the control untreated silage.
- Number of yeast and mould CFU of control silage was the highest (4.5 x 10^4 CFU/g FM) among all kind of treated ones, which was significant on P 1% level.
- Weight loss and DM loss were lower in all of the lactic acid bacteria treated silages in general than it was measured in the control silage. Least weight loss and one-third of DM loss was detected in *Lactobacillus plantarum* 100.000 CFU/g treated silage among all kind of silages.

Keywords: whole crop maize silage, lactic acid bacteria strain, *Lactobacillus plantarum*, chemical composition, weigh and DM loss

INTRODUCTION

The object of the trial was to study the effect of *Lactobacillus plantarum*, *Enterococcus faecium and Lactococcus lactis* lactic acid bacteria (LAB) strains applied them by in itself and with combination of *Lactobacillus plantarum* on the chemical composition, energy- and metabolisable protein (MP) content, microbiological characteristics and in-silo weight- and dry matter loss of whole plant maize silages during the fermentation and 95 days of storage.
Microbiological inoculants are the dominant silage additives in most part of the word nowadays. The aim is to have a rapid and efficient fermentation, minimizing weight and DM loss, to reduce the risk of deterioration, to keep nutritive value similar to that of the crop at ensiling (MUCK 2013)
Most of the bacterial inoculants containing homofermentative lactic acid bacteria (LAB) in most cases such as *Lactobacillus plantarum*, secondly *Enterococcus faecium*, *Lactococcus lactis* are often added to silage because they very quickly produce large quantities of lactic acid, which lowers the pH of the silage (LI AND NISHINO 2011, MARCINAKOVA ET AL., 2008)

Homofermentative strains such as *Lactobacillus plantarum*, *Enterococcus faecium* and *Pediococcus spp*. produce the largest reductions in pH, higher lactate: acetate ratios and lower dry matter losses by 1-2% (WEINBERG AND MUCK, 1996).
The mixture of *Lactobacillus plantarum* and *Enterococcus faecium* used inhibited the development of yeast and mould populations in barley silages, both during ensiling and upon aerobic exposure and increased aerobic stability (MCALISTER ET AL., 1995).
DRIEHUIS ET AL. (1999) showed that LAB affected the activity of yeasts in two ways. Firstly during anaerobic conditions, the survival of yeasts is reduced, and secondly, during the aerobic exposure, yeast growth is reduced. Silages treated with inoculants containing various strains of *Lactobacillus plantarum* had lower yeast, moulds, ethanol, and ammonia-N concentrations than did untreated silages.
Some inoculant lactic acid bacteria strains produce anti-microbial compounds that inhibit mould growth or undesirable bacterial species like *Salmonella sp.*, *Listeria sp.* and *Escherichia coli* (GOLLOP ET AL., 2005).
SCHAEFER ET AL. (1989) found inoculants did not inhibit the growth of yeasts or the aerobic deterioration of corn silage. Other researchers have concluded that inoculants improved the aerobic stability of corn silage as measured by a lower mean temperature and a reduction in the disappearance of WSC and lactic acid (WOHLT, 1989, PHILLIP AND FELLNER, 1992).
The additive containing *Lactococcus lactis* NCIMB 30160 has the potential to improve the production of silage from all forages by increasing lactic acid content and the preservation of dry matter, by reducing the pH and moderately the loss of protein, as determined by ammonia-N. (EFSA, 2011).

MATERIAL AND METHOD

Experimental ensilage procedure

The applied treatments:
T1. Untreated, control whole crop maize
T2. *Enterococcus faecium* 100.000 CFU/g FM
T3. *Lactobacillus plantarum* 50.000 CFU/g +
Enterococcus faecium 50.000 CFU/g FM
T4. *Lactococcus lactis* 100.000 CFU/g FM
T5. *Lactobacillus plantarum* 50.000 CFU +
Lactococcus lactis 50.000 CFU/g *FM*
T6. *Lactobacillus plantarum* 100.000 CFU/g FM

Each type of inoculant was individually prepared for application by suspending the appropriate dosage in 100 ml distilled water and then evenly was applying 2 ml solution to 1 kg of fresh forage (FM) repectively. The control untreated silomaize was prepared with the same amount of distilled water to 1 kg FM as well.
The maturity of whole crop maize raw material was in soft cheddar stage of grain ripeness, the dry matter content was 32%. The treated forages were ensiled in airtight 4.2 litre capacity glass micro-size silos, sealed with screw-topped cap. Each treatment prepared in 5 replicates and stored on constant air-conditioned 25 C° room temperature during 95 days. The average packing density was 211 kg DM/m^3.

Chemical-, microbiological and statistical analysis

Dry matter, crude protein, crude fat, crude fiber, crude ash, WSC and NDF content of silages were analysed and the nutritive value (energy and metabolisable protein content) was calculated according to the internationally recognised methods.

Quantity determination of yeast and mould was based on the Hungarian standard MSZ ISO7954 Microbiology: General guidance for enumeration of yeasts and moduls.

Full statistical analyses was using an internationally recognised statistical procedure.

We processed data with the aid of Microsoft Excel program. As method of mathematical statistics, we used the method of comparison of calculated mean values and significance.

RESULTS

The chemical composition of whole crop maize silages and their significance compare to the control one can see on *Table 1*. The calculated nutritive value of he silages see on *table 2*., while the mould and yeast CFU on silages on 95th day of storage can see on *table 3*., and the weight and dry matter loss of silages during 95 days storages show *table 4*.

T1. Control silage

The silage seemed suit for feeding, but mild deficiency of quality was predicted according to the sensory test.

The 31% dry matter content was least compare to the other LAB strain treated silages, which was connected with the highest dry matter loss (3.8%) among all silages.

Yeast and mould CFU of fresh silage was the highest (4.5 x 10^4CFU) among all treated silages, and contained mainly yeast colonies.

T2. *Enterococcus faecium* treated silage

Sensory test showed a good quality of silage.

The chemical composition differed from the control: higher DM, crude fat, N- free extract and WSC content characterised while the other components were less.

The significant differences of the chemical compositions compare with control silage was most frequent among all LAB treated silages. There was no significant in crude ash, WSC surplus and less NDF content.

Microbiological profile was more favourable with 3.5 x 10^3CFU

Fermentation loss was less than in control during 95 days storage: with 0,2 % weight loss, and the DM loss was one third only (with high CV%)

T3. *Lactobacillus plantarum* + *Enterococcus faecium* treated silage

Analyses with sensory test showed not a totally uniform quality, but all samples were unbroken and free from mould.

The differences in chemical composition was significant in case of less protein and fiber and higher N-free extract content compare to the control silages.

DM loss was similar, weight loss was higher a bit than the control during the 95 days of storage.

Table 1. Chemical composition of whole crop maize silages and their significance compare to the control

Parameters		n	Treatments												Treatments	Level of signif. (P%)
			T1 (Control)		T2		T3		T4		T5		T6			
			Mean	s	Mean	s	Mean	s	Mean	s	Mean	s	Mean	s		
Dry matter	**%**	5	31.15	0.40	31.92	0.72	31.34	0.66	31.67	0.59	32.22	0.42	32.04	0.42	T1-T2 T1-T5 T1-T6	5% 5% 5%
Crude protein	**g/kg DM**	5	85.46	1.49	80.52	2.41	80.28	1.51	80.92	0.53	79.18	2.84	80.94	0.75	T_1-T_2 T_1-T_3 T_1-T_4 T_1-T_5 T_1-T_6	5% 5% 5% 5% 5%
Crude fat	**g/kg DM**	5	29.26	2.00	32.04	2.11	26.72	2.41	29.84	3.46	28.44	2.95	30.30	2.07	T_1-T_2	5%
Crude fiber	**g/kg DM**	5	216.56	9.86	198.40	10.16	200.22	13.05	207.80	13.41	210.16	10.67	189.56	12.30	T_1-T_2 T_1-T_3 T_1-T_6	5% 5% 5%
Crude ash	**g/kg DM**	5	46.20	2.42	44.30	2.54	43.16	0.92	45.08	2.14	46.44	2.17	46.04	1.46	T_1-T_3	5%
N-free extract	**g/kg DM**	5	622.50	10.80	644.72	10.35	649.62	13.13	637.06	14.97	635.78	9.53	653.12	11.68	T_1-T_2 T_1-T_3 T_1-T_6	5% 5% 5%
WSC	**g/kg DM**	5	27.78	10.26	33.08	11.41	19.28	6.01	28.20	6.07	8.90	2.21	4.40	4.71	T_1-T_5	5%
NDF	**g/kg DM**	5	432.80	21.20	427.06	35.20	414.87	25.84	416.94	25.52	442.58	27.39	396.80	35.79	-	ns

Table 2. Calculated nutritive value of whole crop maize silages on DM basis

Parameters		Mean of treatments (n=5)					
		T1 control	T2	T3	T4	T5	T6
Dry matters	**%**	31.15	31.92	31.34	31.67	32.22	32.04
MPE	**g/kg DM**	71.8	71.4	71.4	71.4	71.3	71.5
MPN	**g/kg DM**	50.8	47.9	47.8	48.1	47.1	48.1
ME	**g/kg DM**	10.53	10.62	10.55	10.57	10.53	10.59
NE(m)	**MJ/kg DM**	6.78	6.87	6.81	6.82	6.79	6.84
NE(g)	**MJ/kg DM**	4.24	4.33	4.28	4.29	4.26	4.30
NE(l)	**MJ/kg DM**	6.42	6.48	6.4	6.45	6.43	6.46
UDP	**g/kg DM**	24.8	23.4	23.3	23.6	23.0	23.5

Table 3. Mould and yeast CFU of silages on 95th day of storage

Treatment	Yeast- and mould CFU (n=5)		Yeast- and mould CFU (n=5)		
	CFU/g	Mean	Treatment	CFU/g	Mean
T1	1. $3.3x10^4$	$4.5x10^4$	**T4**	1. $1.6x10^3$	$1.2x10^3$
	2. $4.4x10^4$			2. $1.2x10^3$	
	3. $3.7x10^4$			3. $1.2x10^3$	
	4. $5.9x10^4$			4. $1.0x10^3$	
	5. $5.1x10^4$			5. $1.3x10^3$	
T2	1. $3.2x10^3$	$3.5x10^3$	**T5**	1. $3.9x10^3$	$3.3x10^3$
	2. $3.3x10^3$			2. $2.9x10^3$	
	3. $3.3x10^3$			3. $4.5x10^3$	
	4. $3.2x10^3$			4. $3.1x10^3$	
	5. $4.4x10^3$			5. $2.3x10^3$	
T3	1. -	$4.1x10^3$	**T6**	1. $3.0x10^3$	$3.1x10^3$
	2. $3.3x10^3$			2. $3.5x10^3$	
	3. $3.6x10^3$			3. $2.7x10^3$	
	4. $4.4x10^3$			4. $3.3x10^3$	
	5. $4.9x10^3$			5. $3.2x10^3$	

Table 4. Weight and dry matter loss of fermentation during 95 days storage

Treatment	Loss of Fermentation		Treatment	Loss of Fermentation	
	Loss of weight %	Loss of dry matter %		Loss of weight %	Loss of dry matter %
T1 control			***T4***		
mean	**0.9**	**3.8**	mean	**1.1**	**2.5**
s	0.2	1.3	s	0.4	1.6
CV %	18.0	33.8	CV %	37.0	66.5
T2			***T5***		
mean	**0.7**	**1.2**	mean	**0.9**	**0.5**
s	0.3	2.2	s	0.1	1.3
CV %	46.8	185.4	CV %	10.3	245.4
T3			***T6***		
mean	**1.5**	**3.6**	mean	**0.6**	**1.0**
s	0.9	2.0	s	0.1	1.3
CV %	61.3	55.6	CV %	9.7	135.8

CONCLUSIONS

Comparison of the efficiency of some homofermentative lactobacillus strains such as *Lactobacillus plantarum, Enterococcus faecium and Lactococcus lactis* applied in itself or combined them with *Lactobacillus plantarum* on ensiling of whole crop maize has given opportunity to draw a lesson as follows:

We expected that the applied LAB strains protect nutritive value, decrease the risk of deterioration throught a favourable microbiological profile, promote to reduce weight and DM loss better than in untreated silage as it was introduced by number of authors (see chapter Introduction).

Our experiments proven them right in most of the case:

- Chemical composition of whole crop maize silages treated by lactic acid bacteria strains are significantly differed on P 5% level from the control in some cases but the nutritive value (energy and MP content) of silages did not change significantly compare to the control untreated silage.
- Number of yeast and mould CFU of control silage was the highest (4.5 x 10^4 CFU/g FM) among all kind of LAB treated ones.
- Weight loss and DM loss were lower in all of the lactic acid bacteria treated silages in general than it was measured in the control silage. Least weight loss and one-third of DM loss was detected in *Lactobacillus plantarum* 100.000 CFU/g treated silage among all kind of silages.
- There was no synergetic effect of the combination of *Enterococcus faecium* or *Lactococcus lactis* with *Lactobacillus plantarum* inoculant for chemical composition and nutritive value of silages.

REFERENCES

DRIEHUIS, F., OUDE ELFERINK, S., SPOELSTRA, S. (1999) Anaerobic lactic acid degradation during ensilage of whole crop maize inoculated with Lactobacillus buchneri inhibits yeast growth and improves aerobic stability. Journal of applied Microbiology 87: 585–594.

EUROPEAN FOOD SAFETY AUTHORITY (EFSA) (2011) Scientific Opinion on the safety and efficacy of Lactococcus lactis (NCIMB 30160) as a silage additive for all species, EFSA Journal 9(9):2366

GOLLOP, N., ZAKIN, V., WEINBERG Z. 2005. Antibacerial activity of lactic acid bacteria included in inoculants for silage and in silages treated with these inoculants. Journal of Applied Microbiology 98: 662–666.

LI Y., NISHINO N. (2011) Monitoring the bacterial community of maize silage stored in a bunker silo inoculated with *Enterococcus faecium*, *Lactobacillus plantarum* and *Lactobacillus buchneri*. J Appl. Microbiol. 110, pp.1561–1570.

MARCIŇÁKOVÁ M., LAUKOVA A., SIMONOVA M., STROMPFOVA V, KORENEKOVA B., NAĎ P. (2008) "Probiotic properties of Enterococcus faecium EF9296 strain isolated from silage," Czech Journal of Animal Science, 2008, 53, pp. 336–345,

MCALLISTER, T., SELINGER, L., MCMAHON, L., BAE, H., LYSYK, T., OOSTING, S., CHENG, K. (1995) Intake, digestibility and aerobic stability of barley silage inoculated with mixtures of Lactobacillus plantarum and Enterococcus faecium. Canadian Journal of Animal Science 75: 425–432.

MUCK R. E. (2013) Recent advances in silage Microbiology Agricultural and Food Science, 22, pp. 3-15

PHILLIP, L. E., UNDERHILL, L. E. AND GARINO, H. (1990) Effects of treating lucerne with an inoculum of lactic acid bacteria or formic acid upon chemical changes during fermentation and upon the nutritive value of the silage for lambs. Grass Forage Sci. 45: 337-344.

SCHAEFER, D. M., BROTZ, P. G., ARP, S. C. AND COOK, D. K. (1989) Inoculation of com silage and high-moisture corn with lactic acid bacteria and its effect on the subsequent fermentations and on feedlot performance of beef steers. Anim. Feed Sci. Technol. 25: 23-38

WOHLT, J. E. 1989. Use of silage inoculant to improve feeding stability and intake of a com silage-grain diet. J. Dairy Sci. 72: 545-55 1.

WEINBERG, Z.G., MUCK, R.E. (1996) New trends in development and use of inoculants for silage. FEMS Microbiol. Rev. 19, 53 168.

Review on Agriculture and Rural Development 2017 vol. 6 (1-2) ISSN 2063-4803

INVESTIGATION OF PHENOLOGICAL DEVELOPMENT OF SOME EPHEMERAL ANNUAL ORNAMENTAL PLANTS IN REGARD TO NITROGEN APPLICATION

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ABSTRACT
Nitrogen sensitivity of *Cyanus segetum* Hill. (cornflower), *Consolida regalis* GRAY. (larkspur) and *Papaver rhoeas* L. (poppy) was investigated in outdoor experiment with ammonium-nitrate fertilizer application. The aim of our study was to prove the harmful effect of fertilization on segetal vegetation degradation.
The examination method based on horizontal and vertical plant parameters, on phenological stages comparison.
The height of poppy was decreased significantly when 240 kg/ha nitrogen was applied. Significant vegetative growth was detected on the other two species investigated especially higher doses of nitrogen application. Nitrogen application had an adverse effect on cornflower stem strength. Stress tolerance of poppies was decreased in the highest application. The other two species was not detected any biotic or abiotic damage compared to the control and treated plots.

Keywords: cornflower, larkspur, poppy, fertilizer, archaeophytes

INTRODUCTION

Nitrogen plays a vital role in the physiology of plants. It is an essential building block of proteins and pigments. Not surprisingly there is a strict correlation between the nitrogen content of a leaf and photosynthesis, as enzymes participating in the Calvin-cycle and thylacoids give the vast majority of it is nitrogen content (EVANS, 1989). It is an easily mobilized macronutrient, which has influence on the plant's vegetative growth. Several factors affect the uptake (HARGITAI, 2005).
The applied complex fertilizer and ammonium nitrate significantly reduced the number of dicotyledonous species in the flora of the borders of arable land (PYŠEK AND LEPŠ, 1991). The negative effect of application of fertilizer, herbicide and their combination on archaeophytes examined in the trial was statistically proved in every treatment. During the trial the diversity of plant associations were reduced, however the weight of fresh biomass of the fertilized plots exceeded the untreated control (KLEIJN AND SCHNOEIJING, 1997, SCHMITZ, 2014). The diversity reduction effect of the application of fertilizers achieved by the enhanced growth and spread of high nutrient intake species. The number of lower nutrient intake – lower (between 3 and 4) Ellenberg N-value – species gradually decreased. The rate of the damage rise in mid-term, which leads to the disappearance of certain species (SCHMITZ, 2014). Later regeneration of the slowly spreading species is difficult, because of the isolated populations where gene exchange is not possible (BISCHOFF AND MAHN, 2000). Because of the altered growth intensity of certain species the shading changes, which directly influences diversity. The dry weight of biomass was higher on the untreated plot, but individual plants grew higher on the treated ones, because of decreasing proportion of red/far red the tissues elongation. Application of fertilizers has an indirect

influence on the diversity – through the modification of light conditions – of border associations of arable land (KLEIJN AND VAN DER VOORT, 1997). Similar, low biomass weight was observed in the case of application of 20 kg/ha nitrogen. The competition between archaeophytes and cereals was not for the nitrogen, but for light. The effect of the nitrogen on competition is different in each species. Competition reaches it is height before flowering (IQBAL AND WRIGHT, 1997). Some researchers think, that nitrogen has a direct effect, which acts together with the competition. This can be the cause of the reaction of different species to fertilization which has no correlation with their ecological indicator value (PYŠEK AND LEPŠ, 1991).

MATERIALS AND METHODS

The trial was set up in 2016 at the Show Garden of the Faculty of Horticulture and Rural Development of Pallas Athena University (46° 55' 10" N, 19° 41' 13" E). The soil is sand based, continuously cultivated, weed free. The setting up of plots and plowing to 20 cm depth was on 22nd of February 2016. Even, aerated, small particle size sowing bed was made after plowing, 15 plots total was sown. Cornflower and delphinium seeds were incorporated 1-2 cm deep, poppy seeds were scattered on the surface. Sowing was not irrigated due to adequate soil moisture, the weather forecast predicted ample precipitation. During the trial we did not applied any form of agro- or phytotechnical method, the plants were extensively maintained.

Seeds quantities sown:

- *Cyanus segetum:* 0.4 g (approx. 200 seeds)
- *Consolida regalis*: 0.5 g (approx. 400 seeds)
- *Papaver rhoeas* (formula mixture): 0.04 g (approx. 400 seeds)

Plant species in the same treatment were put in one plot, there was a 30 cm walkway between treatments. The setting up of plots were made with a 50 m tape measure, the edges were marked with 50 cm wooden sticks. One plot was 1.5 × 1.5 m. The fertilizer (ammonium nitrate) was applied on 13th of April, 2016 on the 12 plots. Each plot received 20.25 g, 40.5 g, 81 g and 162 g, which is equivalent of 30, 60, 120, 240 kg/ha nitrogen active ingredient.

Measured an observed parameters, methodology:

- Observing the cotyledons, stems and leaves in comparison with the untreated plots especially on deformations, difference on leaf with, length, color, and general health of plants, once a week.
- Further observations on phenology, like plant width and height measurements before flowering, and height measurement after flowering, and assessing the ornamental value twice weekly from the beginning of flowering.
- Comparison of developmental speed based on horizontal and vertical plant parameters, on phenological stages.

The statistical assessments were made by using one or multifactorial analyses of variance (ANOVA, MANOVA) and multifactor correlation tests. Significant difference was determined by Tukey's test, Least Significant Difference and Games-Howell tests (α=0.05). For assaying we used SPSS 20 program (IBM, New York, US).

RESULTS AND DISCUSSION

Cyanus segetum

During the analysis of data gathered at the assessment of 19th of May Pearson's correlation analysis showed a close relationship within the 3 measurements (pairwise comparisons of width, length and height showed that the two-sided significance level was below 0.001 in each pairing) so these data were assessed together.

The 3 factorial MANOVA showed significant effect (Wilk's lambda value F=5.436, SL<0.001). Deviation within the groups in the case of width and length can be considered homogenous (Levine's test SL>α), but was not fulfilled in the case of height, so for this parameter we used the Games-Howell test's result. Residues showed normal distribution on all 3 datasets (Kolmogorov-Smirnov test SL>α).

Table 1. Comparative pairwise analysis on the effect of nitrogen application on *Cyanus segetum*'s width and length

	TREATMENT	Sample size	WIDTH (cm)			LENGTH (cm)	
			1	2	3	1	2
Tukey HSD[a,b,c]	Untreated	20	14.25			14.65	
	30 kg/ha	20		18.75		18.75	18.75
	60 kg/ha	20		20.25	20.25		19.05
	120 kg/ha	20		22.25	22.25		22.60
	240 kg/ha	20			23.30		22.40
	Sig.		1.000	0.086	0.177	0.063	0.094

Examining the plant's width the pairwise comparison shows 3 significantly distinct groups (SL<0.05). Table 1. shows that the untreated plants had the smallest inflorescence size compared to all other treatment. Significant difference was shown only between the smallest (30 kg/ha) and highest (240 kg/ha) doses of nitrogen. 30 kg/ha dose of nitrogen have not had size increasing effect compared to the untreated. Statistically supported difference was shown at 60, 120 and 240 kg/ha doses (*Table 1.*)

Table 2. Pairwise analysis of the effect of nitrogen treatment of *Cyanus segetum* (assessment dates are 19th of May and 8th of July in 2016.)

TREATMENT	Sample size	HEIGHT (cm) 19th of May 2016.		TREATMENT	HEIGHT (cm) 8th of July 2016.	
		1	2		1	2
Untreated	20	13.55		Untreated	73.85	
30 kg/ha	20		21.25	120 kg/ha	79.10	79.10
240 kg/ha	20		21.45	30 kg/ha		84.25
60 kg/ha	20		23.20	240 kg/ha		84.30
120 kg/ha	20		24.90	60 kg/ha		85.25

Games-Howell test showed similar result in regard of plant height (*Table 2*). In this case plants were also significantly smaller (SL<0.05) in the untreated plot at the time of the first assessment. There was no significance detected between the nitrogen treatments.

Assessment made when plants finished their vertical growth (8th of July). ANOVA data analysis showed significant effect (F=2.698 SL=0.035<α). Normality was accepted based

on kurtosis and skew. Based on post hoc test (Least Significant Difference) all treatments – except 120 kg/h nitrogen – enhanced the plants final height (SL<0.05).

Consolida regalis

A close relationship was also observed in this case within the 3 measurements (Pearson's correlation SL<0.01). MANOVA showed a strong significance (F=4.600, SL<0.001). Normality test was carried out with the inspection of skew and kurtosis of residues (were between +1.5 and -1.5 interval in both datasets, TABACHNICK AND FIDELL, 2013). Treatments had significant effect only in the case of width and length. Levine's test was acceptable only in width (SL>α) while in length we used Games-Howell test.

Table 3. Comparative pairwise analysis on the effect of nitrogen application on *Consolida regalis* width and length

TREATMENT	Sample size	WIDTH (cm)			LENGTH (cm)		
		1	2	3	1	2	3
Untreated	20	14.00			12.10		
30 kg/ha	20	17.10	17.10			15.40	
120 kg/ha	20		19.45	19.45		17.05	17.05
60 kg/ha	20		19.90	19.90		18.40	18.40
240 kg/ha	20			20.60			19.55
Sig.		0.092	0.158	0.881			

Taking a closer look on the width of plants we can determine, that – the exception of smallest nitrogen dose – all treatments had significant effect on at least one horizontal parameter of a plant. Between the treatments only the smallest and highest doses had verifiable differences (SL<0.05). The values of length had similar results, with the difference that for this dimension all treatments had significantly bigger plant sizes compared to untreated plants (*Table 3.*).

Table 4. Pairwise analysis of the effect of nitrogen treatment of plant height of *Consolida regalis* (8th of July 2016).

	TREATMENT	Sample size	**HEIGHT** (cm) 8th of July 2016.	
			1	2
Tukey HSD[a,b]	Untreated	20	65.40	
	120 kg/ha	20		82.85
	30 kg/ha	20		83.00
	60 kg/ha	20		86.15
	240 kg/ha	20		88.35
	Sig.		1.000	0.879

Height measurements assessed at the end of the trial showed significant effect (F=4.871 SL<0.01). The normality test of residues (Kolmogorov-Smirnoff test, SL>α), and the Levine's test (SL>α) showed statistically proven difference (SL<α) between the untreated and treated plants vertical increase (*Table 4*).

Papaver rhoeas

Investigating the width and length of poppy we have found correlation (Pearson's correlation SL<0.001).

The normality test was accepted for the residuals of both dataset (Kolmogorov-Smirnov test SL>α), but in this case treatments had no significant effect on horizontal parameters of the plants (MANOVA F=1.567 SL=0.176>α).

The data of height showed normal distribution (investigation of skew and kurtosis). Treatments had strong significant effect on the vertical dimensions of plants (ANOVA F=4.463, SL<0.01). Based on the results of Levine's test (SL>α) for pairwise comparison we used Tukey's test.

Table 5. Comparative pairwise analysis on the effect of nitrogen application on *Papaver rhoeas* height (19th of May 2016)

	TREATMENTS	Sample size	HEIGHT (cm)		
			1	2	3
Tukey HSD[a,b]	30 kg/ha	20	13.30		
	Control	20	14.20	14.20	
	60 kg/ha	20	18.70	18.70	18.70
	240 kg/ha	20		20.95	20.95
	120 kg/ha	20			21.70
	Sig.		0.230	0.074	0.771

Results show, only the 120 kg/ha dose differed in this phenophase from the untreated (SL<0.05). Nobody should make far-reaching conclusions from this data, because the assessment was made at the beginning of flower stem growth (*Table 5*).

Table 6. Pairwise analysis of the effect of nitrogen treatment of plant height of *Papaver rhoeas* height (8th of July 2016)

TREATMENTS	Sample size	HEIGHT (cm) 8th of July 2016.	
		1	2
240 kg/ha	20	84.50	
120 kg/ha	20	95.30	95.30
30 kg/ha	20	96.55	96.55
60 kg/ha	20		102.40
Untreated	20		106.00

Height measurements made at the end of the growing cycle showed altered results. The conducted statistical tests (ANOVA F=5.717 SL<0.001, Levene's test SL<α, normality of residues) and the Games-Howell test showed the negative effect of treatments (*Table 6*). Plant size decreased with the higher dose of treatment, and became significant at 240 kg/ha compared to the untreated control (SL<0.01).

CONCLUSIONS

Vegetative growth by application of nitrogen fertilizer was statistically proven in our trial in the case of *Cyanus segetum* and *Consoloda regalis*, which corresponds earlier

references. Treatments however had no effect on the width and length of *Papaver rhoeas*, moreover instead of helping the elongation of internodes plant height stagnated or decreased.

We observed other effect of nitrogen over fertilization. In cornflower – which is often prone to falling over – nitrogen application increased elongation, which decreased the wind resistance of plants. Weed coverage was the same as in the untreated plot, but floppy plants were aesthetically disturbing at the end of flowering. Biotic stress tolerance was not impaired, the pests severity (mostly aphids) was identical with the untreated plot, and had no effect on flowering. On the *Consolida regalis* plots we could not detect any biotic or abiotic damage caused by the treatments. The only abnormality we saw was the twisting of flower stalks, but it was also present in the untreated plot. Weed coverage was higher on the untreated plot, because of smaller plant sizes, but this had no effect on it is decorative value. On the leaves of *Papaver rhoeas* distortion, chlorotic blotches were observed, some plants died. Also increased aphid infestation occurred at the beginning of flower stalk formation, mainly on the treatments of 120 and 240 kg/ha.

REFERENCES

BISCHOFF, A., MAHN, E-G. (2000): The effects of nitrogen and diaspore availability on the regeneration of weed communities following extensification. Agriculture, Ecosystems and Environment. Vol. 77, pp. 237-246.

EVANS, J. R. (1989): Photosyntesis and nitrogen relationship in leaves of C_3 plants. Oecologia. Vol. 78, Nr. 1, pp. 9-19.

HARGITAI L. (2005): Talajtan és agrokémia II. Alkalmazott talajtan és agrokémia. Budapesti Corvinus Egyetem, Kertészettudományi Kar. Budapest. pp. 161-174.

IQBAL, J., WRIGHT, D. (1997): Effects of nitrogen supply on competition between wheat and three annual weed species. Weed Research. Vol. 37, pp. 391-400.

KLEIJN, D., SCHNOEIJING, G. I. J. (1997): Field boundary vegetation and the effects of agrochemical drifts: botanical change caused by low levels of herbicide and fertilizer. Journal of Applied Ecology. Vol. 34, pp. 1413-1425.

KLEIJN, D., VAN DER VOORT, A. C. L. (1997): Conservation headlands for rare arable weeds: the effects of fertilizer application and light penetration on plant growth. Biological Conservation. Vol. 81, pp. 57-67.

PYŠEK, P., LEPŠ, J. (1991): Response of weed community to nitrogen fertilization: a multivariate analysis. Journal of Vegatation Science. Vol. 2, pp. 237-244.

SCHMITZ, J., HAHN, M., BRÜHL, C. A. (2014): Agrochemicals in field margins – An experimental field study to assess the impacts of herbicides and fertilizers on a natural plant community. Agriculture, Ecosystems and Environment. Vol. 193, pp. 60-69.

TABACHNICK, B. G., FIDELL, L. S. (2013): Using Multivariate Statistics. 6th edition. Boston: Pearson. pp. 96-97.

Review on Agriculture and Rural Development 2017 vol. 6 (1-2) ISSN 2063-4803

SEVERITY OF SYMPTOMS OF EUROPEAN STONE FRUIT YELLOWS ON DIFFERENT APRICOT VARIETIES

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ABSTRACT
Apricot is an important fruit crop in Hungary. There are large growing areas consisted of orchards of different sizes. These orchards are highly affected by a disease complex the so cold apoplexy with its characteristic symptoms. In this study, the effect of rootstocks and scion varieties on the severity of symptoms was investigated in an apricot orchard near Budapest. Symptoms were assessed in autumn at their most characteristic appearance on the combinations of 5 different scion varieties and 3 different rootstocks in 3 consecutive growing seasons. According to the results of the assessments in most cases, symptoms proved to be more frequent and stronger on trees grown on wild apricot rootstock than on plum intergrafted or myrobalan rootstocks. The variety Mandulakajszi proved to be consistently the least affected variety particularly on plum intergrafted rootstocks. Severity of symptoms observed on other investigated varieties deviated depending on the different rootstocks and growing seasons. To reduce the effect of growing seasons monitoring should be continued.

Keywords: apricot, rootstocks, scions, disease, apoplexy, symptoms

INTRODUCTION

Edaphic circumstances and climatic conditions of Hungary favour for growing apricots. Recently the total area of apricot production is about 5.000 ha.
In the orchards of the most important Hungarian apricot production areas 'yellows' symptoms, progressive necrosis, decline, and eventual death of the trees are present. Apoplexy is one of the most important diseases of apricots. Appearance of its symptoms is almost inevitable in the plantations. The annual decay of a producing orchard is between 5-10% in each year, depending on environmental and growing conditions. Apoplexy is a complex disorder which is difficult to study and treat because symptoms are caused by different pathogens separately or as a complex. Causes of the disease have been investigated in Hungary for a long time. KLEMENT ET AL. (1972) identified *Pseudomonas syringae* pv. *syringae* bacterium and *Valsaria insitiva* (syn. *Cytospora cincta*) fungus as the main causative agents. However, the above-mentioned pathogens only play a secondary role in disease development like do growing and environmental conditions. Recent studies lead to the conclusion that '*Ca.* Phytoplasma prunorum' - associated with European stone fruit yellows (ESFY) disease – is the primary cause of the dieback. Symptoms first appear in the beginning or in the middle of the summer and often involves only a few branches at first but later the whole tree may become affected as the disease progresses. Shoots on infected trees are typically shorter. Early leaf yellowing or growth of latent buds which produce chlorotic leaves usually accompanied by leaf roll followed by early phylloptosis and total decay of the tree. Fruits on diseased branches develop poorly

and may fall prematurely. The disease can affect the flowers as well, which often leads to lack of fruit set.

Symptoms of ESFY are less typical than that of caused by other phytoplasmas and are often very similar to that of caused by viruses and bacteria or to disorders caused by different pesticides.

The prokaryote *Ca*. Phytoplasma prunorum infects plant species belonging to the Prunus genus. Symptoms can be observed on e.g. Japanese plum (*Prunus salicina*), peach (*Prunus persica*), flowering cherry (*Prunus serrulata*) (LORENZ ET AL., 1994) and on many rootstocks for stone fruits (KISON AND SEEMÜLLER, 2001). However, the pathogen can survive and multiply in the host asymptomatically as well. Concerning grafted plants the severity of symptoms on the scions is dependent on the susceptibility of the rootstock. Several studies showed that apricot is more severely affected on GF8/1 rootstock than on rootstocks of *Prunus domestica* selected genotypes or on *Prunus cerasifera* (myrobalan) (AUDERGON ET AL., 1991; AUDERGON AND BUISINE,1985; DOSBA ET AL., 1991; MORVAN, 1977). AUDERGON ET AL. (1991) observed differences in the susceptibility of different apricot varieties as well. According to the studies of KISON AND SEEMÜLLER (2001) severity of symptoms is influenced by the virulence of the pathogens and the different rootstock/scion combinations too.

The phytoplasma lives mainly in the sieve tubes of the plant phloem tissue. Colonization of the phloem is depending from the seasons (LEE AND DAVIS, 1992; SEEMÜLLER ET AL., 1984). According to some studies the multiplied phytoplasma cells clog the pores of the vascular system, while others report that this cannot cause the frequently observed intensive phloem necrosis (BRAUN AND SINCLAIR, 1976, 1978; SCHNEIDER, 1973). The amount of the pathogen within the woody parts of the plant is varying during the vegetation period. The highest level of phytoplasmas can be found generally at the end of summer or in early autumn which causes the appearance of the strongest symptoms in this period. The secondary formation of phloem tissues makes possible the survival of the pathogen within woody plant parts of stone fruits even in winter (SEEMÜLLER ET AL., 1998). According to DOUGLAS (1993) phytotoxins contribute to the development of characteristic symptoms. It is not sure whether the plant produces the toxins as a consequence of the infection or the pathogen produces them. The toxins disseminating within the plant cause malfunction of the cells and consequently the development of the symptoms. This phenomenon may explain why phytoplasmas were not detected in diseased plant parts in some studies (PARTHASARATHY, 1974; LEÓN ET AL., 1996).

MATERIAL AND METHOD

According to the related literature, the severity of symptoms depends on the differences among the growing seasons, the varieties and the rootstocks. In this present study, the effects of these factors on disease severity were investigated. Five varieties (’Gönci magyarkajszi’, ’Magyarkajszi’, ’Tomcot’, ’Mandulakajszi’, ’Bergeron’) grown in an apricot orchard (Sóskút, Hungary) on myrobalan (*Prunus cerasifera*), wild apricot and myrobalan with plum intergrafted rootstocks were involved in the assessment (*Table 1*). The apricot plantation was established in 2001 with an open vase training system. Distance between rows and plants are 7 m and 4 m, respectively.

Table 1. Rootstock/scion combinations

Scions	Rootstocks		
	Myrobalan	Plum intergrafted r.	Wild apricot
Bergeron	x	x	x
Gönci magyarkajszi	x	x	x
Magyarkajszi	x		
Mandulakajszi	x	x	x
Tomcot	x		

Monitoring has been carried out for three consecutive years (2014-2016). Severity of symptoms was assessed in autumn in each year when their appearance proved to be the most severe. Eighty trees from each variety were classified into disease categories according to the severity of the symptoms. For the calculation of disease severity a four grade scale was used (*Table 2*).

Table 2. Scales used for the assessment of disease severity

Grade	Description
0	Tree with no symptom
1	Tree with mild symptoms
2	Tree with moderate symptoms
3	Tree with heavy symptoms / already died tree

Statistical analysis was carried out from different perspectives. In the first case, the effect of rootstocks to the development of symptoms was evaluated within the cultivars. In the second case, the effect of varieties grafted onto the same rootstock was evaluated to the evolution of the symptoms. The results were evaluated in the different years separately. Crosstabulation was carried out with Pearson's Khi-square test. In case of significant result, adjusted residuals were analysed as a post hoc test. Throughout the analysis, IBM SPSS 23 was applied.

RESULTS

The frequencies of apoplexy symptoms were remarkably high in the investigated apricot orchard in each year concerned. Level of disease incidence exceeded 70% in certain varieties.

Effect of the rootstocks on disease severity

Bergeron

Regarding the apricot variety Bergeron frequency of diseased trees was significantly different on all types of rootstocks in 2014 ($p<0.05$). Trees on Myrobalan rootstock were most affected by the disease while the least number of occurrences was on wild apricot rootstock in 2014. The highest number of diseased trees was observed on wild apricot rootstock in 2015 and on intergrafted plum rootstock in 2016. However, there were no significant differences among the rootstocks in the years 2015 and 2016 ($p>0.05$). Severity of symptoms was similarly high on trees grafted to the different rootstocks in 2014. The same tendency could be observed in 2015 and in 2016. The least severe symptoms occurred on trees on myrobalan while the strongest symptoms developed on trees on wild apricot rootstock. Deviation among the different rootstocks was significant ($p<0.05$) only in 2015 (*Figure 1*).

Gönci magyarkajszi

Regarding the apricot variety Gönci magyar kajszi the highest number of diseased trees could be counted in the populations on wild apricot rootstock in each year. Significant differences among the rootstocks could be observed in 2014 and 2016 ($p<0.05$). In these years, the least number of disease occurrences was on plum intergrafted rootstock. Similar tendency could be observed in each year concerning disease severity. The strongest symptoms developed on trees on wild apricot rootstock while trees on plum intergrafted rootstock remained the healthiest. Deviation among the different rootstocks was significant in 2014 and in 2016 ($p<0.05$, *Figure 1*).

Mandulakajszi

Regarding the apricot variety Mandulakajszi frequency of diseased trees on the different rootstocks deviated significantly only in 2016 ($p<0.05$). Symptoms could be observed most frequently on trees on wild apricot, in the same time, the least number of occurrences could be counted on myrobalan in this year. The trees grafted to wild apricot showed the strongest symptoms in the years investigated. The healthiest trees were found on intergrafted plum in 2014 and 2016 and on myrobalan in 2015. Deviation among the different rootstocks was significant in every year investigated ($p<0.05$, *Figure 1*).

Effect of the scions on disease severity

Myrobalan

Regarding the rootstock Myrobalan frequencies of diseased trees of the different varieties showed similar patterns in 2014 and in 2015 from which the data obtained in 2016 slightly differed. Trees of the variety Tomcot were most affected in 2014 and in 2015 as well. The least number of occurrences was observed in Mandulakajszi in 2014 and with almost the same occurrences in Bergeron and in Mandulakajszi in 2015. The highest number of diseased trees was observed in Gönci magyar kajszi in 2016, however the deviation of frequency was not significant compared to the varieties Tomcot, Bergeron and Magyarkajszi ($p>0.05$). The fewest number of the trees of Mandulakajszi showed disease symptoms in 2016 as well. The differences in the occurrences of the symptoms were significant in each year investigated in this variety ($p<0.05$). Heavy severity frequency of the symptoms were the strongest in Magyarkajszi in 2014, in Magyarkajszi and Tomcot in 2015, and in Tomcot and Gönci magyar kajszi in 2016. Concerning disease heavy severity, the least affected trees were found in Mandulakajszi with a significant difference compared to other varieties ($p<0.05$, *Figure 2*).

Plum intergrafted

The effect of scions on disease severity was assessed on plum intergrafted rootstock in three varieties Bergeron, Gönci magyar kajszi and Mandulakajszi. Occurrences of symptoms were not affected significantly by the varieties in any of the years investigated ($p>0.05$). Nevertheless, significant differences in severity of symptoms were found in more cases ($p<0.05$). The strongest symptoms developed on Bergeron in 2014 and on Bergeron and Gönci magyar kajszi in 2015 and 2016. The significantly least affected trees were observed in Mandulakajszi in each year ($p<0.05$, *Figure 2*).

Wild apricot

Regarding wild apricot rootstock, the significantly highest number of diseased trees was observed in Gönci magyar kajszi in each year investigated ($p<0.05$). The fewest trees was affected in Mandulakajszi and in Bergeron with almost the same frequency in 2014. The least affected population was in Manadulakajszi in 2015 and in Bergeron in 2016. The

strongest symptoms were observed in Gönci magyar kajszi in 2014 and in 2016 as well. The varieties Bergeron and Gönci magyar kajszi were affected the most in 2015 with similar severity of symptoms. The trees of Mandulakajszi remained the healthiest in each year with significant deviation compared to the other varieties ($p<0.05$, *Figure 2*).

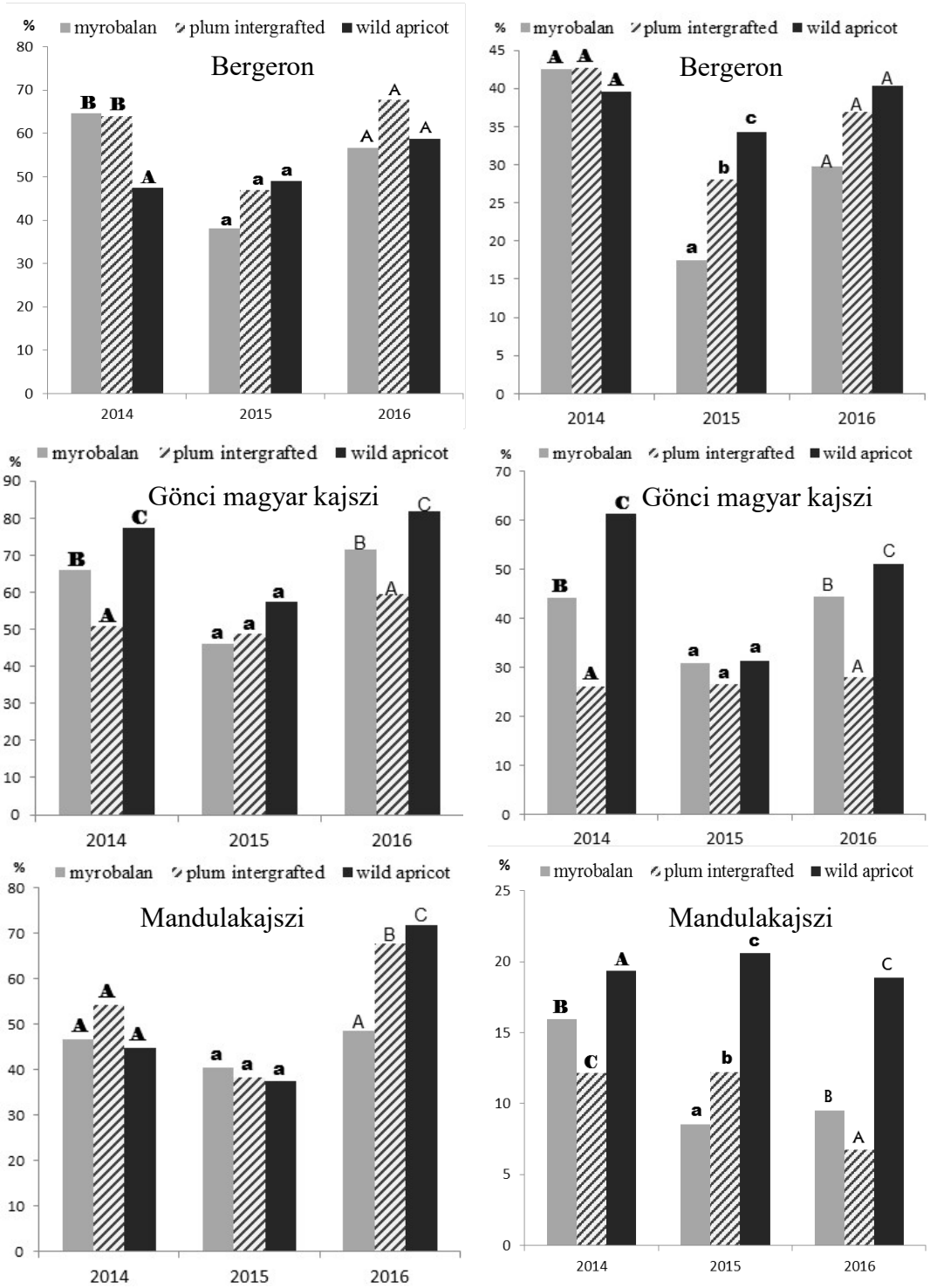

Figure 1. Frequency of trees with symptoms (grade 1, 2 or 3, left) and frequency of trees with heavy symptoms (right) on the different rootstocks.
Different letters are for significantly different groups (Pearson's Chi-square, $p<0.05$)

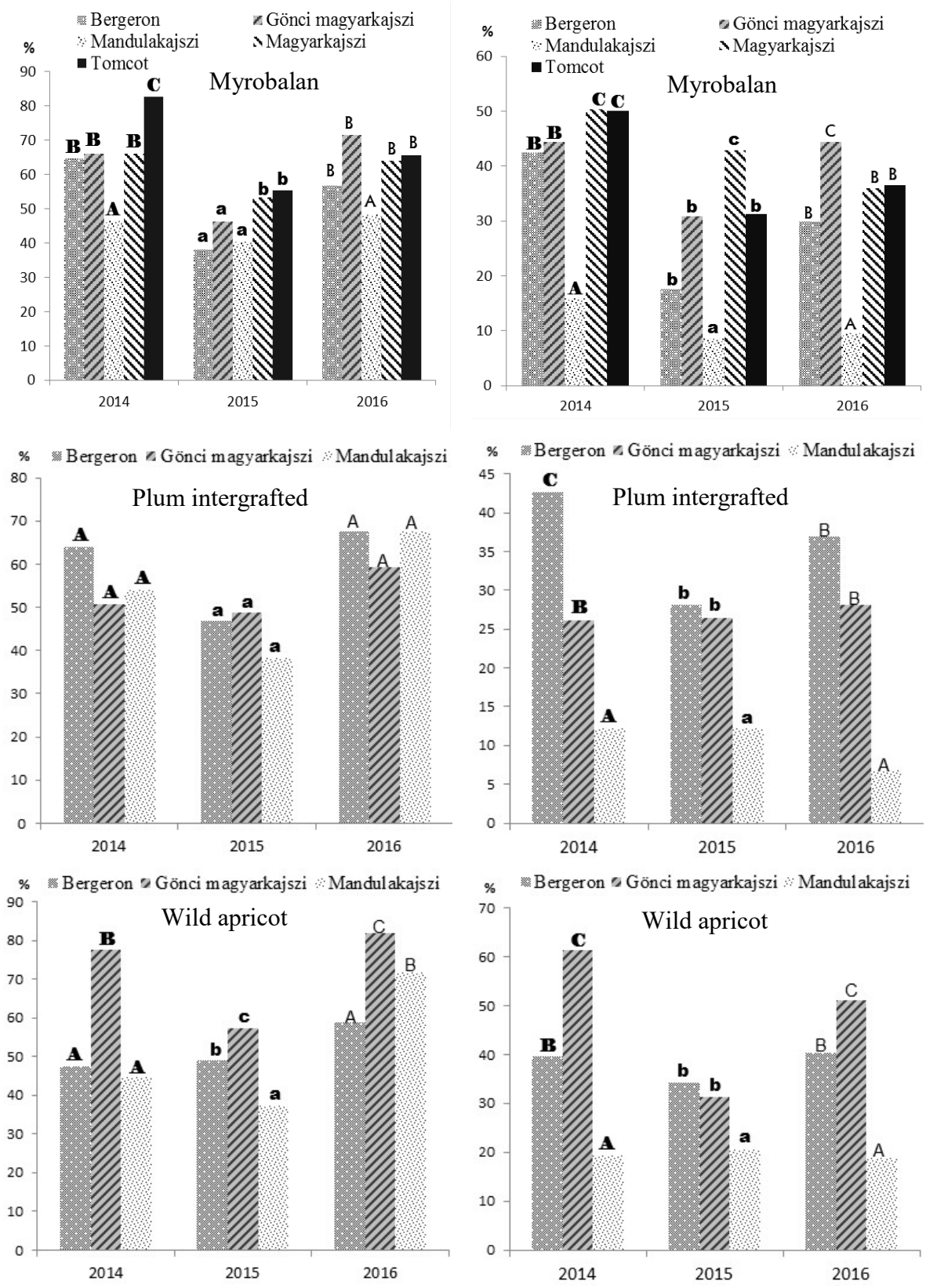

Figure 2. Frequency of trees with symptoms (grade 1, 2 or 3, left) and frequency of trees with heavy symptoms (right) on the different varieties.
Different letters are for significantly different groups (Pearson's Chi-square, $p<0.05$)

CONCLUSIONS

Symptoms of apoplexy were observed in high frequency in the investigated apricot orchard in each year. At the same time trees were less affected in 2015.
The effect of the different rootstocks on disease frequency deviated depending on growing seasons and varieties. Nevertheless, in the most cases symptoms could be observed in the highest frequencies on varieties grown on wild apricot rootstock. The higher susceptibility of this rootstock was particularly visible on the bases of the assessments of severity of symptoms. The least affected trees were on plum intergrafted rootstock apart from the few exceptions observed.
The effect of the different varieties on disease severity could be observed principally on the bases of the assessments of severity of symptoms. Mandulakajszi proved to be consistently the least affected variety particularly on plum intergrafted rootstocks. Severity of symptoms observed on other investigated varieties deviated depending on the different rootstocks and growing seasons.
Based on the results only preliminary conclusions can be drawn. In order to confirm the results of the survey monitoring should be continued in the following years.

REFERENCES

AUDERGON, J. M., C. CASTELAIN, G. MORVAN, M.-G. CASTELLIEÁRE (1991): Behaviour of 150 apricot varieties after an apricot chlorotic leaf roll inoculation. Acta Horticularae 293: 593-598.
AUDUBERT A., BUISINE F. (1985): Le verger d'abricotier en Pyrénnées Orientales – Une enquete sur la mortalité des jeunes arbres. Info CTIFL 12: 9.
BRAUN, E.J., SINCLAIR, W.A. (1976): Histopathology of phloem necrosis in Ulmus americana. Phytopathology 66: 598-627.
BRAUN, E.J., SINCLAIR, W.A. (1978): Translocation of phloem necrosis-diseased American elm seedlings. Phytopathology 68: 1733-1737.
DOSBA, F., M. LANSAC, K. MAZY, M. GARNIER, J. P. EYQUARD (1991): Incidence of different diseases associated with mycoplasma-like organisms in different species of Prunus. Acta Horticulturae 283: 311-320.
DOUGLAS, S.M. (1993): Cytology, histology, and histochemistry of MLO infections in tree fruits. In: Handbook of Cytology, Histology, and Histochemistry. A.R. Biggs (ed). CRC Press, Inc., Boca Raton, FL, 253-279.
KISON, H. AND SEEMÜLLER, E. (2001): Differences in strain virulence of the European stone fruit yellows phytoplasma and susceptibility of stone fruit trees on various rootstocks to this pathogen. Journalof Phytopathology 149(9): 533-541.
KLEMENT Z., ROZSNYAY ZS., MARTOS A. (1972): A téli fagy és a lombhullás utáni állapot szerepe a baktériumos kajszi gutaütésben. Növényvédelem 8: 209-214.
LEE, I-M. AND DAVIS, R.E. (1992): Mycoplasmas which infect plants and insects. 379-390. In: J. Maniloff, R.N. McElhansey, L.R. Finch and J.B. Baseman (eds.): Mycoplasmas: Molecular Biology and Pathogenesis, American Society for Microbiology, Washington DC, USA.
LEÓN, R., SANTAMARIA, J.M., ALPIZAR, L., ESCAMILLA, J.A. AND OROPEZA, C. (1996): Physiological and biochemical changes in shoots of coconut palms affected by lethal yellowing. New Phytologist 134: 227-234.

LORENZ, K.-H., F. DOSBA, C. POGGI POLLINI, G. LLACER, E. SEEMÜLLER (1994): Phytoplasma diseases of Prunus species in Europe are caused by genetically similar organisms. Z. Pflkrankh. Pflschutz 101: 567-575.
MORVAN, G. (1977): Apricot chlorotic leaf roll. EPPO Bull. 7: 37-55.
PARTHASARATHY, M.V. (1974): Mycoplasmalike organisms associated with lethal disease of palms. Phytopathology 64: 667- 674.
SCHNEIDER, H. (1973): Cytological and histological abberations in woody plants following infections with viruses, mycoplasmas, rickettsias and flagellates. Annual Reviews, Phytopathology 1: 119-146.
SEEMÜLLER, E., MARCONE, C., LAUER, U., RAGOZZINO, A., GÖSCHL, M. (1998): Current status of molecular classification of the phytoplasmas. Journal of Plant Pathology 80: 3-26.
SEEMÜLLER, E., SCHAPER, U., ZIMBELMANN, F. (1984): Seasonal variation in the colonization patterns of mycoplasmalike organisms associated with apple proliferation and pear decline. Z. Pflanzenkrankh. Pflanzenschutz 91(4): 371-382.

Review on Agriculture and Rural Development 2017 vol. 6 (1-2) ISSN 2063-4803

THE EXAMINATION OF HUMIC SUBSTANCES IN SOILS AND COMPOSTS WITH HIGH ORGANIC CONTENT WITH DIFFERENT METHODS

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ABSTRACT
The organic materials, especially the complex structural humic substances are acid-characteristic polymers which are key elements of soils. Despite their relatively small quantity, humic substances have beneficial effects on soil nutrient management, development of optimal soil structure, regulation of soil temperature, and proper water management.
The application of the UV-VIS spectrophotometry for describing humic substances in soils and determining of humifical state is nowadays a widespread method. The E4/E6 procedure (which were determined between 465 and 665 nm wavelength) and the Hargitai-method (the extinction of extracts measured between 400 and 750 nm at 9 wavelength) are procedures that have become the general tool for determining the quality of humic matters because of its easy accessibility and smaller need of instrumentations. Nevertheless, their usefulness has been criticized in scientific communities because of the high human error factor and the technical limitations of the simpler spectrophotometric instruments. Nowadays the spreading light scattering photometric examinations using lasers as the Static Light Scattering (SLS) or the Dynamic Light Scattering (DLS) could be a new way of measuring the quality of the humic matters.
This study is based on the examination of different quality soil and compost samples which were extracted from different Hungarian sites like Trizs, Szárítópuszta and Csobánc. Additionally, not only the soils and composts were analyzed but also any soil conditioners (biochar, bone charcoal) which were applied and affected their properties.
The main goal of the research was to measure the soil and compost samples with the E4/E6 and the Hargitai-method and with also using Zetasizer Nano ZS device that could lead to more detailed results about the weight and the size of the humic molecules.
Based on the summarized analytic results the outcomes of the E4/E6 procedure is applicable for drawing relevant conclusion regarding the humic quality of the given sample. On the contrary, the applied Hargitai-method has not proved to be effective. Although the measurement of the molecule's size and weight with the Zetasizer Nano ZS device has brought out exciting results and displayed similarities with the E4/E6 outcomes, only it's tendencies proved to be informative because of its methodological background.

Keywords: E4/E6 ratio, Hargitai-method, Zetasizer Nano ZS, humic substances, charcoal

INTRODUCTION

The nutrient and toxic element buffering capacity of soils are highly dependent on the organic fraction of soil (SPOSITO, 1989), thus the replacement of organic matter (OM) and the promotion of humification is indispensable. The level of OM content in soils can be increased by using composts or pyrolyzed organic materials (biochar). Both materials have high carbon content. The mineralization and transformation of composts in soils are faster (~10 years), while the pyrolyzed organic matter (charcoal, bonechar) are only slightly degrading over a century (LEHMAN ET AL., 2009). Because of the different impacts of the soil conditioners in the soil-system is it essential to parameterize its mode of action in order the efficient soil quality improvement. One of the parametrization tools is the examination of the appearance and quality of the humic material. The most common tool

for analyzing the quality of the humic material is the UV-VIS spectrometric examination which includes the our used E_4/E_6 and the Hargitai methods. One of the key results in our research is that we could observe the differences between the two methods during the analyzation of our given samples. The measurement with the Zetasizer Nano Zs device has confirmed our comparative study.

MATERIAL AND METHOD

For our examinations, the following materials were used: brown forest soils from two different regions of Hungary (Gödöllő, Trizs); topsoil of three brown forest soils collected from charcoal burning piles that were used 25, 35, and 80 years ago; compost made of green wastes; bonechar, and charcoal (*Table 1*).

Table 1. Parameters of the samples used in our research

	Soil Gödöllő	Soil Trizs	25-year-old Soil-charcoal	35-year-old Soil-charcoal	80-year-old Soil-charcoal	Compost	Charcoal	Bonechar
pH_{KCl}	5.7	3.9	5.0	4.7	3.9	8.3	8.3	7.6
C (%)*	0.75	4.4	12	10	5.1	20	80	10

* carbon content determined by Loss on ignition method

The soil science literature divides the humic substances to three basic group according to their solubility these are the fulvic acids (FA), humic acids (HA) and the humic materials (HM). The size and weight of the molecules and the nitrogen contents are increasing from the fulvic acids to humic materials, while their oxygen content is decreasing. In the case of the UV-VIS spectrophotometric methods these characteristics can distinguish the differences between the analyzed humic samples.

The detection of aqueous HA and FA solution's optical density or absorbance can be made at 465 and 665 nm (E_4/E_6) and between 400 nm and 750 nm at 9 wavelength (Hargitai-method). These measurements are widely used for the characterization of humic substances. Although the E_4/E_6 ratio and the Hargitai-method have different examination procedure and evaluation they are related to the degree of condensation of the aromatic carbon network, carbon content, and molecular weight of humic substances (KONOVA, 1966; SCHNITZER AND KHAN, 1972; TAN, 2003). FA, with lower molecular weight, have higher (6-8,5); whereas the HA, with higher molecular weight and better quality, have lower (<5) E_4/E_6 ratios (STEVENSON, 1994). Although by the usage of two solvents at the Hargitai-method the denser humic materials are solvable more efficiently than in case of the E_4/E_6 method, however the results can be drawn only by using multiple and complicated calculations (RÉTHÁTI ET AL., 2015).

The weight and size of the molecules in the given sample solution can be measured by laser light scattering where the *Zetasizer Nano* device can measure in wide range of test concentration. In this respect, the it can be an adequate supplementary to the UV-VIS spectrometric procedures.

From the obtained results of the E_4/E_6 the Hargitai-method and the Zetasizer Nano measures, we would like to draw conclusions about the quality of the organic matter.

The preparation E_4/E_6 of the samples was carried out in two steps. First, we centrifuged three grams of the samples with 30 cm^3 2% HCl solution in 50 cm^3 centrifuge tubes (5 minutes, 5000 rpm) in order to dissolve carbonates. This step was repeated one more time after the supernatant was discarded. After discarding the HCl containing supernatant, 30

cm^3 of distilled water was added to the samples and centrifuged again in order to remove the remnant of HCl. The second step was the organic matter extraction, in which after discarding the supernatant of the distilled water, 30 cm^3 0.5 mol NaOH solution was given to the samples, and was put into a rotary shaker for 24 hours. After shaking, the samples were centrifuged (25 minutes, 5000 rpm), then the supernatant was diluted to the required concentration, and the absorbance of the solutions were measured and 465 and 665 nm. The measurements were carried out by Jenway 6405 UV/Vis- Spectrophotometer (RÉTHÁTI ET AL., 2015).

In case of Hargitai-method two solvents were used; 0.5% NaOH and 1% NaF solutions. We gave to every air-dry sample 20-20 cm^3 solvent then for 48 hours we stored them at 5 ^oC temperature cold storage. As the next step, we gave distilled water to the solvent sample to make dilution of 1:5 and 1:10. After that, similarly to the E_4/E_6 procedure, we used the Jenway 6405 UV/VIS spectrophotometry device at 9 wavelength (between 400 and 750 nm) to measure the samples. Then on a given sample we divided the absorbance values of the NaF solution by the values of the NaOH solution which resulted a Q stability number. We divided the Q number by all humic content (according to Tyurin; mark: H) which lead to the humic stability coefficient values (K). According to the values in the table of Hargitai we classified the measured samples by their potential humic content (BUZÁS, 1988).

At the Zetasizer Nano ZS measures we mainly focused on the soil charcoal systems (from charcoal burning piles that were used 25, 35, and 80 years ago). With using the static light scattering (SLS) we defined the average molecular weight of the given solution sample, while with the dynamic light scattering (DLS) we detected the average molecular size. Like at the E_4/E_6 process, we used 0.5 M NaOH solvent, and the whole sample preparation procedure was the same as far as the prior to, detection phase. The measurement was carried out at a constant 25 ± 0.1 °C external temperature, while for illuminating the samples we used 4 mW He-Ne laser. The prepared solutions were dosed at a glass cuvette and were examined in 1 ml quantities. All measurements were repeated three times. At the dynamic light scattering measurements we detected the scattered light in two mode, at 173° (back scattering mode) and at 180° (dual-angle) mode.

The analyses were repeated three times and the results were statistically tested. The analysis of the variance program was used for data assessment in Microsoft Office Excel Macro. The program was developed based on Sváb's algorithm (1981). It was successfully used in several publications (KOVÁCS ET AL., 2013; SZABÓ ET AL., 2013; RÉTHÁTI ET AL., 2015).

RESULTS AND DISCUSSION

The average absorbance values of the NaOH extracted humus substances, that was measured at 465 and 665 nm, can be found in *Table 2*. The color of the NaOH extracted samples was brown, which means that all samples contained some acidic humus substances. The exception is that concerning the charcoal and bonechar samples significant amount of humic substances cannot be dissolved by NaOH from the samples. This phenomenon can be seen from the colorlessness of the dissolved samples, which in case of the charcoal were caused by the pyrolysis generated aromatic ring structure. In the case of the bonechar it was caused by the high calcium and phosphate content level which was diluted during the acidic sample preparation phase.

The rest of the sample E_4/E_6 values of all the samples were below 6, which indicate the presence of humic acids. Since the extraction was carried out by 0.5 M NaOH solution, we do not have to consider great pH-dependence of the E_4/E_6 ratios of the fulvic acids (CHEN

ET AL., 1977). The E_4/E_6 ratio of the brown forest soils (Gödöllő, Trizs) were 4.94 and 5.67, respectively, which indicate high amount of fulvic acid compared to the soils treated with charcoal and compost. The humus substances with complicated structure and lower E_4/E_6 values formed in composts (E_4/E_6 = 3.14) and in soil-charcoal system with different ages (E_4/E_6 = 2.71-3.51) can be due to the intensive microbial activity. The lowest E_4/E_6 value was in case of the 35 year-old soil-charcoal system ($E_4/E_{6(35yr)}$ = 2.71), which might be due to the fact that humification process was the most intensive and the most progressed (RÉTHÁTI ET AL., 2015).

Table 2. The average absorbance of the samples, measured at 465 and 665 nm, and the E_4/E_6 ratios

	Soil Gödöllő	Soil Trizs	25-year-old Soil-charcoal	35-year-old Soil-charcoal	80-year-old Soil-charcoal	Compost	Charcoal	Bonechar
465 nm	0.47	0.99	2.79	2.72	2.16	2.86	0.18	0.02
665 nm	0.10	0.17	0.80	1.00	0.64	0.91	0.04	0.01
E_4/E_6	4.94	5.67	3.51	2.71	3.35	3.14	4.93	1.40

In case of the Hargitai-method the humification state of the given sample can be described by using the calculated K values to classify on a scale from 0.001-10, where the low number indicates primary humic release forms and the higher number means a more complicated structured humic substances. The measured results of the Hargitai method are shown in *Table 3*.

Table 3. Results of the Hargitai-method

	Control	25 years	35 years	80 years	Csobánc settlement
Q	3.483	0.5994	0.6273	0.4785	2.9172
H	4.06	12.63	11.77	6.13	8.7
K	0.86	0.05	0.05	0.08	0.34

The expected results of the Hargitai-method are not displaying a high degree of identity with the E_4 / E_6 ratios, because of the K values results have described the humification state reversely (25-35-80 years sample contains more complex, higher-molecular humic substances) comparing what we have expected. The Hargitai method's test results can be interpreted more precisely if we examine the C / N ratio of the sample to define the state of humification (TAN, 2003).

The static light scattering (SLS) molecular weight measurement results of the Zetasizer Nano ZS device can be read in *Table 4*. Our examination in this case was oriented to the soil charcoal systems, which illustrates well the time dimension of the humification process. The results of the molecular weight measurement by far exceeds the publicized literature's 500-1,360,000 Da values for humic substances; (CHIN ET AL., 1994; STEVENSON, 1994; TAN, 2003; KAWAHIGASHI ET AL. 2011). The static light scattering measured results of molecular weight contrary to the Hargitai-method, comparable with the E_4 / E_6 method's results, and it confirms the experienced tendencies.

Table 4. The results of SLS measures

Name of the sample	T (°C)	MW (kDa)	A2c mL mol/g²	Standard deviation of NaOH (kcps)	Toluol standard deviation (kcps)
Controll	25	**1180**	5.24E-04	67.3	245.7
25 years	25	**3790**	3.54E-04	84.1	246.5
35 years	25	**5070**	3.94E-04	33.1	234
80 years	25	**1.24E+04**	9.02E-04	34.2	292.9
Soil Gödöllő	25	**1050**	1.80E-04	41.1	239.8

Determining the average hydrodynamic diameter related to the dynamic light scattering (DLS) definable weight of the solution was not lead to obvious results. Because the results of the measurements displayed more significant particle presence in the range from 1000 to 10,000 nm, therefore our measured humic substances could be in the range, but they were not being able to be identified. The reason for this fact is the complex content of the samples (sedimenting mineral particles containing soil samples).

CONCLUSIONS

In conclusion, the different types of UV-VIS spectrometry methods (E4/E6 and Hargitai) which we used are not sufficient by themselves for determining perfectly the humic state of a given soil, however they can be used for determining a kind of humification index for soil improving purposes (CHEN ET AL., 1977, KUMADA, 1985, STEVENSON, 1994, TAN, 2008).

In case of the E_4/E_6 method, the values for determining the humification level, which we predicted, were confirmed. The forest soil samples had higher (4.97-5.67) E_4/E_6 ratios, while the soil-charcoal systems and the composts (2.71-3.51), that had easily mobilizable organic matter fractions, had lower E_4/E_6 ratios. Regarding the Hargitai's method for determining the quality of humus the samples with more advanced humification status progress in contrast to the expectations displayed lower K values as the lass advanced samples.

The results of the SLS and DLS measurements, which were made on Zetasizer Nano ZS device, have proved difficult to interpret because of their solutions are showing the properties both the association colloids and polyelectrolytes and with a relatively minor change on circumstances the colloidal dispersion characteristics too.

Regarding the Zetasizer Nano ZS measurements, it caused problems that we tested complex soil solutions which contained both organic as well as inorganic fractions. SLS-molecular weight and DLS-molecular size determinations and the results become unstable due to these facts, however during the SLS measurements of the E_4/E_6 correlating measurements were established trend in the case of the soil as well. The result's usefulness of the SLS molecular weight and DLS molecular size measurements are questionable because of these factors, however the SLS measurements have shown correlating tendencies with E_4/E_6 in case of soil solutions.

In the soil solutions compared to other organic molecules the humic substances have unique behavior and they are more sensitive for the changes of the solution's parameters.

REFERENCES

BUZÁS, I. (1988): Talaj és agrokémiai vizsgálati módszerkönyv 2. A talajok fizikai-kémiai és kémiai vizsgálati módszerei. Mezőgazdasági Kiadó- Budapest

CHEN, Y., SENESI, N., SCHNITZER, M. (1977): Information Provided on Humic Substances by E_4/E_6 Ratios. Soil. Sci. Soc. Am. J. 41(2): 352-358.

CHIN, Y. P., AIKEN, G. & LOUGHLIN E. O., (1994): Molecular weight, polydispersity and spectroscopic properties of aquatic humic substances. Environmental Science and Technology 28: 1853–1858.

FILEP, GY. (1988): Talajkémia. Akadémiai Kiadó, Budapest, 293 p.

KAWAHIGASHI, M. ET AL. (2011): Particle Sizes of Standard Humic Substances Calculated as Radii of Gyration, Maximum Diameter and Hydrodynamic Radii, Humic Substances Research 8: 6.

KONOVA, M.M. (1966): Soil organic matter. Pergamon Press, Oxford p. 400-404

KOVÁCS, ZS., TÁLLAI, M., KÁTAI, J. (2013): Examination on the effect of lead and copper heavy metal salts on soil microorganisms under laboratory circumstances. Növénytermelés 62 Suppl.: 261-264.

LEHMANN, J., JOSEPH, S. (ed.)(2009): Biochar for Environmental Management.science and Technology. Earthscan, London. pp. 183-200.

NÉMET, T. (1996): Talajaink szervesanyag-tartalma és nitrogénforgalma, MTA Talajtani és Agrokémiai Kutatóintézete, Budapest, pp. 35-56.

RÉTHÁTI, G., LABANCZ, V., TOLNER, L., SZALAI, Z., ALEXA, L. (2015): Examination of humic substances of composts and differently aged soil-charcoal systems. XIV. Alps-Adria Scientific Workshop Neum, Bosnia and Herzegovina, Növénytermelés / Crop production 64 Suppl.: 103-106.

SCHNITZES, M., KHAN, S.U. (1972): Humic substances in the environment. Marcel Dekker, New York. pp. 57-60.

SPOSITO, G. (1989): Soil organic matter. The chemistry of soils. New York: Oxford University Press, pp. 51-56.

STEFANOVITS, P., FILEP, GY., FÜLEKY, GY. (1999): Talajtan. Mezőgazda Kiadó, Budapest. 470 p.

STEVENSON, F.J. (1994): Humus Chemistry, John Wiley & Sons, 496 p.

SVÁB, J. (1981): Biometriai módszerek a kutatásban. Mezőgazdasági Kiadó, Budapest

SZABÓ, A., BALLA-KOVÁCS, A., KREMPER, R., KINCSES, S-NÉ., VÁGÓ, I. (2013): A tápközeg és az angolperje (Lolium perene L.) jelzőnövény P- és K- tartalmának alakulása különböző komposztdózisok alkalmazásakor. Talajvédelen (Különszám): 459-468.

VELASCO, M.I. (2004): Analysis of humic acid from compost of urban wastes and soil by fluorescence spectroscopy, Agriscientia, 8 p.

TAN, K.H (2003): Humic Matter in Soil and the Environment, Marcel Dekker, Inc., New York, 371 p.

Review on Agriculture and Rural Development 2017 vol. 6 (1-2) ISSN 2063-4803

COMPOSITION OF GRAPE VARIETIES OF THE PLANTATION AREAS AND GUEST NIGHTS IN COMMERCIAL ACCOMMODATION ESTABLISHMENTS IN WINE REGIONS

EDIT PALLÁS

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ABSTRACT
Hungary is one of Europe's traditional wine-producing countries. The grape and wine industry has a significant role in rural areas in culture, gastronomy, tourism and social life. Hungary has 22 wine regions in seven distinct regions. The main data on the wine regions, the grape varieties of the plantation areas as well as the guest nights in commercial accommodation establishments will be presented.
The diverse and varied state of wine regions has been formulated by varied topography, soil and weather conditions, different crop production methods as well as by the local possibilities. The composition of grape varieties in a given region is significantly heterogeneous, which makes integrated action towards purchasers rather difficult.
It would be advisable to select and promote a desirable type or types of wine for each wine region since it would greatly support sales and marketing activities.
The grape and wine sector is among the strategic areas for improvement in Hungary. It is important to emphasize that the future of the wine sector cannot be achieved without cooperation, the potentials of which will be referred to. I am convinced that this analysis will help assess wine regions and determine viable development options.

Keywords: wine region, composition of grape varieties, tourism, accommodation establishments, clusters

INTRODUCTION

Despite its good potentials Hungary is not ranked among the world's leading wine producers. In our country 22 wine regions can be found on a relatively small area. It results in lack of wineries of great volume, standard quality and continuous supply. However, wine regions cover larger areas so it is interesting to examine what grape varieties dominate in the wine region concerned. The market opportunities of the wine regions that act unanimously can significantly increase for a single variety when compared to the current situation.

MATERIAL AND METHOD

Data on the National Council of Wine Communities collected by the Central Statistical Office (CSO) in 2013 are summarised to present the grape varieties of the wine regions. Similarly, by summarising the data of the wine regions the number of guest nights spent in the commercial accommodation facilities of the wine regions is presented. On the basis of these numbers comparisons are made and conclusions are drawn.

Data of wine regions

a.) Balaton wine region
This wine region includes six sub-wine regions. In the wine regions more than ten thousand farmers cultivate an area of 7 576 hectares. Data on grape varieties are summarised by *Figure 1*.

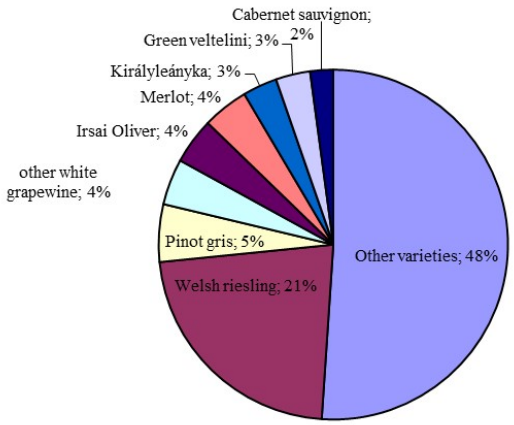

Figure 1. Composition of the plantation area of Balaton wine region per grape varieties grown, 2013

* calculated per area harvested, rounded data
Source: author's own editing based on CSO data

The number of guest nights spent in commercial accommodation facilities also refers to the volume of possible wine consumption (*Table 1*).

Table 1. The number of guest nights spent in commercial accommodation facilities in the Lake Balaton region, 2014

Name	Number of guests	Number of guest nights
hotel	736 904	2 551 096
pension	53 540	150 358
holiday home	69 877	252 445
community accommodation	78 487	246 550
camp site	144 626	585 141
Total	**1 083 434**	**3 785 590**

Source: author's own editing based on CSO data

b.) The Danube wine region is made up by three sub-wine regions. It is the largest wine region of the county in terms of both its area and yield. The main varieties of the wine region are presented by *Figure 2*.

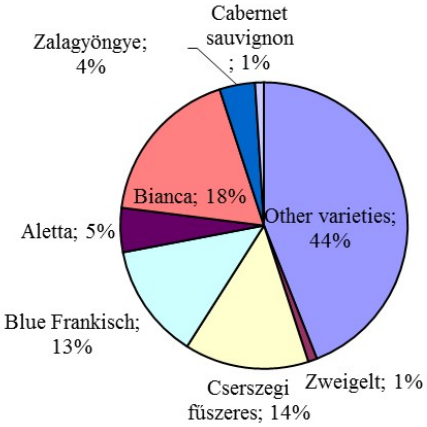

Figure 2. Composition of the plantation area of the Danube wine region per grape varieties grown, 2013

* calculated per area harvested, rounded data
Source: author's own editing based on CSO data

The number of guest nights spent in commercial accommodation facilities in the region is presented by *Table 2*.

Table 2. The number of guest nights spent in commercial accommodation facilities in the Danube region, 2014

Name	Number of guests	Number of guest nights
hotel	352 710	733 244
pension	54 619	109 794
holiday home	36 616	90 114
community accommodation	29 475	75 827
camp site	33 477	131 390
Total	**506 897**	**1 140 369**

Source: author's own editing based on CSO data

c.) The Eger wine region also consists of three sub-wine regions. Half a million hectolitres of wine is produced on approximately 11 thousand hectares. *Figure 3* presents the main grape varieties of the wine region.

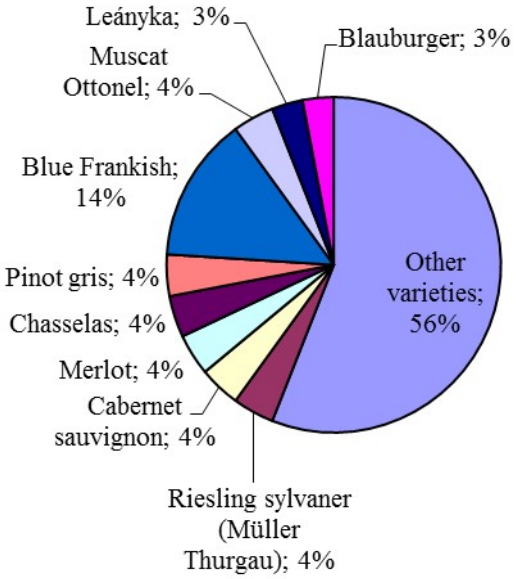

Figure 2. Composition of the plantation area of the Eger wine region per grape varieties grown, 2013

* calculated per area harvested, rounded data

Source: author's own editing based on CSO data

More than half a million guests stay in the commercial accommodation facilities of the region (*Table 3*).

Table 3. The number of guest nights spent in commercial accommodation facilities in the Eger region, 2014

Name	Number of guests	Number of guest nights
hotel	442 302	983 643
pension	54 089	126 779
holiday home	24 239	67 952
community accommodation	59 300	135 857
camp site	24 142	61 321
Total	**604 072**	**1 375 552**

Source: author's own editing based on CSO data

d.) The North Transdanubia wine region is made up by four wine regions. It has a relatively small area with a wide range of choice. The composition of varieties is illustrated by *Figure 4*.

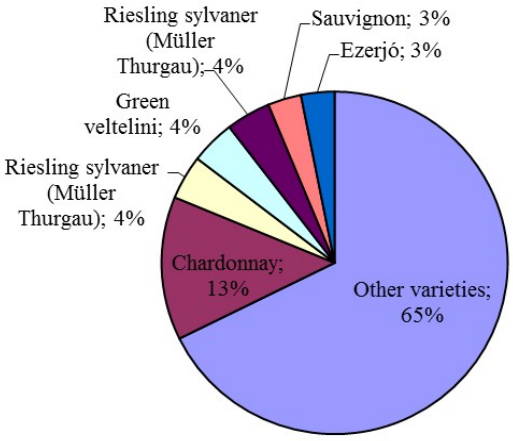

Figure 3. Composition of the plantation area of the North Transdanubia wine region per grape varieties grown, 2013

* calculated per area harvested, rounded data
Source: author's own editing based on CSO data

The information on guest nights in the commercial accommodation facilities can be found in *Table 4*.

Table 4. The number of guest nights spent in commercial accommodation facilities in the North Transdanubia region, 2014

Name	Number of guests	Number of guest nights
hotel	270 677	565 768
pension	43 901	92 096
holiday home	18 055	50 069
community accommodation	19 104	46 389
camp site	11 937	26 029
Total	**363 674**	**780 351**

Source: author's own editing based on CSO data

e.) The Pannon wine region includes the areas of South Transdanubia. It is famous for its excellent red wines. The main varieties are presented by *Figure 5*.

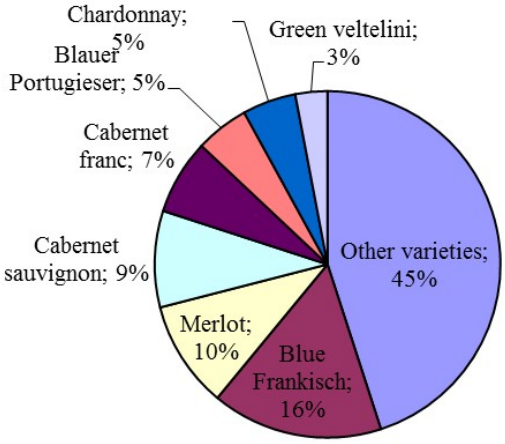

Figure 5. Composition of the plantation area of the Pannon wine region per grape varieties grown, 2013

* calculated per area harvested, rounded data
Source: author's own editing based on CSO data

The information on guest nights in the commercial accommodation facilities can be found in *Table 5*.

Table 5. The number of guest nights spent in commercial accommodation facilities in the Pannon wine region, 2014

Name	Number of guests	Number of guest nights
hotel	184 013	420 161
pension	33 642	64 379
holiday home	8 753	21 761
community accommodation	16 802	34 383
camp site	7 213	22 257
Total	**250 423**	**562 941**

Source: author's own editing based on CSO data

f.) The Sopron wine region is the same as the smaller unit of Sopron wine region. It is dominated by Blue Frankisch (*Figure 6*).

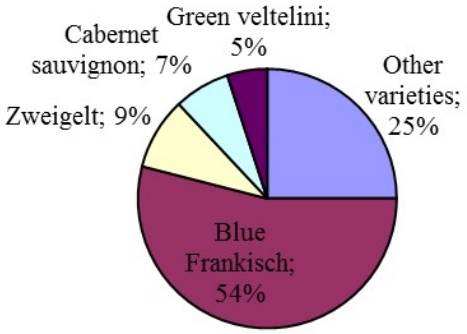

Figure 6. Composition of the plantation area of the Sopron wine region per grape varieties grown, 2013

* calculated per area harvested, rounded data
Source: author's own editing based on CSO data

The number of guest nights in the commercial accommodation facilities is significant (*Table 6*).

Table 6. The number of guest nights spent in commercial accommodation facilities in the Sopron wine region, 2014

Name	Number of guests	Number of guest nights
hotel	146 222	356 306
pension	33 486	66 313
holiday home	1 798	4 011
community accommodation	1 357	3 867
camp site	129	332
Total	**182 992**	**430 829**

Source: author's own editing based on CSO data

g.) In the Tokaj wine region internationally acknowledged wines can be found. The composition of varieties is illustrated by *Figure 7*.

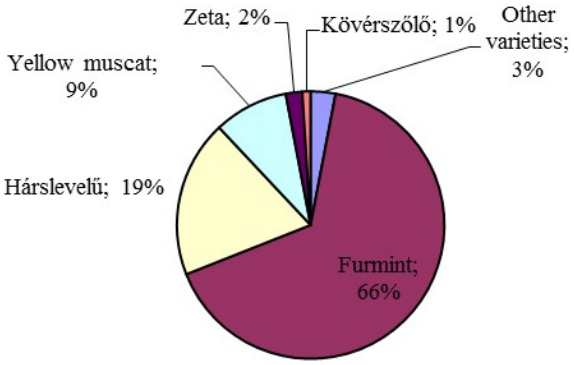

Figure 7. Composition of the plantation area of the Tokaj wine region per grape varieties grown, 2013

* calculated per area harvested, rounded data

Source: author's own editing based on CSO data

The number of guest nights in the commercial accommodation facilities is slight if compared to the reputation of the wine region (*Table 7*).

Table 7. The number of guest nights spent in commercial accommodation facilities in the Tokaj wine region, 2014

Name	Number of guests	Number of guest nights
hotel	32 923	61 148
pension	10 059	21 187
holiday home	14 213	38 575
community accommodation	3 084	10 563
camp site	14 215	35 097
Total	**74 494**	**166 570**

Source: author's own editing based on CSO data

CONCLUSIONS

The grape varieties of the wine regions are extremely heterogeneous. The regional specialisation of wine production is typical of the industry and greatly depends on production factors so creating clusters and networks is possible (SZABÓ, 2006).

The Hungarian wineries have made some results but the overall situation is not favourable (BÉLÁDI AND SZILI, 2015). Regarding grape production and viticulture mainly the Balaton wine region, the Danube wine region, the Eger wine region and the Tokaj wine region can be promising. It would be practical to form clusters in the regions and request support with a well-established concept for development (MARSELEK ET AL., 2014). However, at present its implementation is dubious.

REFERENCES

BÉLÁDI, K., SZILI, V. (2015): A borszőlőtermelés költség- és jövedelemhelyzete. Agrofórum Extra 61: 5-7.

KÖZPONTI STATISZTIKAI HIVATAL (2016): Magyarország borvidékei 2014. Budapest, 48 p.

MARSELEK, S., MÓDOS, GY., VARGA, T. (2014): Klaszterek szerepe a regionális versenyképesség javításában. XIV. Nemzetközi Tudományos Napok, Károly Róbert Főiskola, Gyöngyös, pp. 1031-1039.
SZABÓ, Z. (2006): A bor disztribúciós csatornák marketing szempontú értékelése a borvásárlási szokások és a termelői magatartás vizsgálatán keresztül. PhD értekezés, Gödöllő, 1-161 p.

Review on Agriculture and Rural Development 2017 vol. 6 (1-2) ISSN 2063-4803

GENETIC RESOURCES PROVIDED BY GENETIC ENGINEERING

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ABSTRACT
The approach to genetic modification in plant breeding and the coexistence of traditional and biotech crops is not uniform all over the world. While in the U.S. the ratio of the GM-production reached 30-40%, from which it made no longer sense to differentiate between GM and conventional, in Europe there is great resistance to the new technology. Standpoints are also diverse about the environmental advantages, mainly knowing the facts that e.g. the tendency of herbicide/insecticide consumption in some places was the opposite than expected (increased) or the potential health risks possibly caused by GM foodstuffs. In Hungary the possible future application of GM plants has more disadvantages just right now instead of providing benefits to farmers from environmental, ecological and economical point of view. It seems that consensus is still far away, the debates will go on; the counterparts will abide by their opinions for a long time.

Keywords: Genetic resources, genetic engineering, GMO-s in USA, GMO-s in Europe, GMO-s in Hungary

INTRODUCTION

Crop plants created for human or animal consumption by molecular biological techniques are referred as GMO's (genetically-modified organisms). Genetic engineering can create plants in the laboratory with desired trait(s), e.g. increased resistance to herbicides, weather extremes (droughts, cold) or enhanced nutritional value (protein/sugar content, etc.). This process is much faster than conventional breeding methods (WHITMAN, 2000). During genetic modification, the intended gene is built-in the genome of the plant with the help of a vector that contains other genes, e.g. viral promoters, transcription terminator elements, genes of antibiotic resistance and reporter genes (PUSZTAI ET AL., 2003). The three generations of genetically-modified plants (also called 'transgenic plants') with their possible advantages are shown in *Table 1*.

Table 1. Generations and possible uses of GM plants

FIRST GENERATION TRANSGENIC PLANTS	SECOND GENERATION TRANSGENIC PLANTS	THIRD GENERATION TRANSGENIC PLANTS
Abiotic and biotic stress resistance	**Modification of physiological processes**	**Production of special molecules: 'bioreactors'**
Herbicide resistance: e.g. Round-Up Ready soybean (glyphosate resistant) e.g. 'IMI/SUMO' maize hybrids (imidazolinon/sulphonylurea resistant) *Insecticide resistance:* e.g. Star Link maize (moth resistant)	*modification of metabolism* e. g. protein, carbohydrate metabolism - production of new protein - overproduction of protein - inhibition of protein production *modification of development* (e.g. male sterility, ripening)	e.g. medical, food, plastic industry human proteins, vaccines, phytase 'consumable vaccine' of GM banana

In 2020 an estimated 8 billion people will live on Earth, which will mean massive changes in the production, distribution and stability of food products. With no doubt, new methods in production are needed to feed the increased population of the planet. GM crops could significantly improve crop yields because more food can be grown on less land area. An environmental fact is that after the first some years of using herbicide tolerant GM soybean, seed rape, cotton, corn varieties and insect protected GM cotton, a dramatic reduction of pesticide use was observed (in 2000 total global reduction in pesticide use was 22.3 million kg of formulated product). Reduced use of pesticides can significantly decrease their effects on water quality through run-off and leaching of residues into surface and groundwater. Deployment of insect resistant *Bacillus thuringiensis (Bt)* varieties was estimated to have reduced the total world use of insecticides by 14% (PHIPPS AND PARK, 2002).

Plants could be modified directly to be used for environment preservation purposes, such as:

- *Phytoremediation:* removals of pollution from the environment with the help of plants, e.g. poplar trees have been genetically engineered to clean up heavy metal pollution from contaminated soil (BIZILY ET AL., 2000).
- *Phytoextraction* (or *phytoaccumulation*) uses plants to remove contaminants (heavy metals) from soils, sediments or water into harvestable plant biomass (MEAGHER, 2000).
- *Phytostabilization* focuses on long-term stabilization and containment of the pollutant. Mainly focuses on sequestering pollutants in soil near the roots but not in plant tissues. Pollutants become less bioavailable and livestock, wildlife, and human exposure is reduced. An example application of this sort is using a vegetative cap to stabilize and contain mine tailings (MENDEZ AND MAIER, 2008).

In contrast with the possible advantages of GM plants there are a lot of potential risks; among these the most important is coexistence, e.g. in case of the first generation transgenic plants (PEPO ET AL., 2005; PEPO, 2006). A series of environmental/ecological problems are listed above:

- *Escape of transgene:* (i) during the harvest, *seeds* can be scattered, mixed with seeds of non-GM plants, (ii) in the case of vegetatively propagated plants, *vegetative plant parts* (tubers) can remain in the soil and new plants can develop from them, (iii) canola in Europe can *cross* with weeds and make fertile hybrids,
- *Development of new viruses:* in the cells of GM plants viral RNA synthesized from the virus genes can recombine with the infecting viral RNAs,
- *Development of weeds that can be killed:* enhanced effect of them,
- *Effect on non-target organisms:* e.g. pollens of *Bt* species with high endotoxin content can escape into the environment, killing the useful insects,

Besides the problems mentioned above, risks on human health have to be considered:

- digestibility problems,
- development of allergic reactions,
- toxicity.

Plant with modified metabolism express/overexpress proteins, enzymes and their effects can not be predicted.

The genetically modified organisms (GMO's) are very different in their nature, use and distribution and at the same time they carry wide variety of danger to the environment. That was the driving force behind the idea that we are dealing with GMO's firstly in USA, than Europe and finally because their exceptional situation a separate chapter is paid to Hungary.

RESULTS AND DISCUSSION

GMO's in the USA

Genetically-modified foods are prevalent on the U.S. markets; we speak about not whole vegetables or fruits but processed ones like vegetable oils or breakfast cereals that may contain genetically-modified ingredients in a very small portion. Soybean derivatives also can be present in foods.

From 1996 to 2006 (the first ten years of commercially available genetically-modified plants), herbicide tolerance has consistently been the dominant trait followed by insect resistance and stacked genes for the two traits: 68%, 19% and 13%, respectively. In 2006, GM plants in the U.S. were cultivated on 54.6 million hectares. The major biotech crops were soybean, maize (these two plants are the most widely grown ones, not only in the U.S. but all over the world), cotton, canola, squash, papaya, alfalfa (ISAAA, 2006). Plant varieties meeting the requirements of commercialization determined by the Food and Drug Administration (FDA) and the United States Department of Agriculture (USDA) can be found on 'The List of Completed Consultations on Bioengineered Foods' (for website see REFERENCES)._Genetically-modified varieties have been widely adopted by farmers in the U.S. They expect higher yields and lower pesticide costs. This tendency between 1996 and 2005 is shown on *Figure 1*.

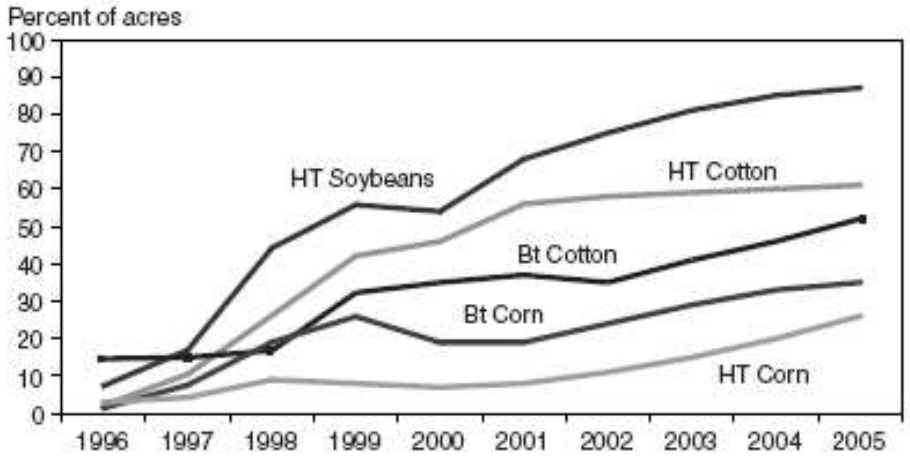

Figure 1. Adoption of genetically-modified crops by U.S. farmers
HT: herbicide tolerant, BT: insect resistant (from *Bt: Bacillus thuringiensis*)
(after FERNANDEZ-CORNEJO ET AL., 2005)

A number of surveys were conducted in the U.S. during recent years on public acceptance of foods containing GE (genetically-engineered) ingredients. In 2003-04, almost half (47%) of the population asked opposed the introduction of GE foods, while only 27% favored. 47% approved or leaned toward approval of the use of GE to make plant-based foods, 41% disapproved or leaned toward disapproval, and 12% were unsure. In 2005, 50% said likely to buy and 45% said not likely to buy GE food produced for better taste or being more fresh; 64% said likely to buy and 32% said not likely to buy GE food produced for decreased pesticide applications (FERNANDEZ-CORNEJO AND CASWELL, 2006).

Despite the expectancies, pesticide use has not decreased since the introduction of GMO's in the first eight years in the US (*Table 2*).

Table 2. Average pesticide pounds applied per acre planted to conventional, herbicide-tolerant (HT) and *Bt* transgenic varieties (BENBROOK, 2004)

	1996	2000	2003
Conventional corn			
Herbicides	2.67	2.13	1.99
Insecticides	0.18	0.18	0.06
GE corn			
Herbicide-tolerant	1.87	1.83	2.32
Bt transgenic	0.16	0.05	0.02
Conventional soybean			
Herbicides	1.20	0.99	0.87
GE soybean			
Herbicide-tolerant	0.84	1.10	1.34
Conventional cotton			
Herbicides	1.93	1.86	1.42
Insecticides	0.56	0.41	0.35
GE cotton			
Herbicide-tolerant	1.58	2.09	2.43
Bt transgenic	0.10	0.10	0.10

Across the three crops, HT varieties increased herbicide use, the two *Bt* transgenic crops reduced insecticide use and all GE crops planted since 1996 have increased corn, soybean, and cotton pesticide use.

GMO's in Europe

To date, the only type of GMO grown in the EU is *Bt* corn. *Bt* corn contains a gene from a bacterium (*Bacillus thuringiensis*) that produces a toxin (*Bt*-toxin) to defend it from the European corn borer (*Ostrinia nubilalis*). The insect pest is present primarily in southern and middle Europe, and is slowly making its way north.

Genetically-modified crops are grown in six countries of the European Union and their cultivation areas are increasing. Data on the last two years are shown in *Table 3*.

Table 3. Cultivation areas (hectares) of *Bt* corn in European countries

Country	2006	2007
Spain	53,700	75,150
France	5,000	21,200
Czech Republic	1,290	5,000
Portugal	1,250	4,199
Germany	950	2,685
Slovakia	30	900

In Spain, a significant amount of the corn production is genetically modified - an estimated 25% of the current production. *Bt* corn was first grown in 1998.

In France, biotech corn has gained strong support among the farmers, who stand to gain more from the crop than any other EU country.

Bt corn was first grown in the Czech Republic in 2005.

Portugal also began producing *Bt* corn in 2005.

Since the 2006 growing season, *Bt* corn cultivars have full approval in *Germany* and are now ready for commercial cultivation. All areas must be declared in a site register.
Slovakia became the newest country in 2006 to plant biotech crops.
In 2006, nearly 80% of Romania's soybean production consisted of herbicide-tolerant varieties. Romanian Government decided to discontinue cultivation of GM soybean upon joining the European Union in January 2007 (GMO COMPASS, 2008; ASEBIO WEBSITE).
Most of the European countries are against GMO. On the 5th of April 2006, the 'Vienna Declaration for a GMO-free Europe' was pronounced by the platform organizing the 'March for a GMO-free Europe' - prepared by the many NGO's (non-governmental organizations) like Global 2000, Greenpeace, and other environmental organizations -, saying: "Transgenic agriculture will have an unacceptable impact on the survival of conventional and organic agriculture in Europe. Without clear prohibition of genetic pollution, the quality of our agriculture cannot be guaranteed. We now face the challenge of protecting our natural and agricultural biodiversity." (…) "Coexistence must not mean contamination. The objective of any legislation on coexistence must be to ensure guaranteed GMO-free agriculture and food production. This means: Who applies genetically modified organisms must strive for zero-contamination. Coexistence measures have to be tailored in such a way that contaminations remain the absolute exception."
Regulations are strict for the authorization of GMO's in Europe. The main instrument is European Community Directive 90/220/EEC - prepared in April 1990, amended for several times (e.g. 2001/18/EC). It regulates the deliberate releases of GMO's for research and development and the placing on the market of genetically-modified products. It provides for an environmental evaluation and a step-by-step approval for the dissemination of GMO's. A case-by-case assessment of the risks to human health, animal health and the environment is carried out prior to a release and the placing of a GMO on the market. It also provides a framework that Member States must accomplish. A national authority in every Member State has to regulate the release of GMO's. Decision-makers have to find balance between interests and opinions of consumers, NGOs, producers, retailers and farmers who influence the authorization process. The consumer group has the most influence on the authorization procedure (BISOFA ET AL., 2001).
Labeling and traceability is among the very strict regulations in Europe. Regulations (EC) No. 1829/2003 and (EC) No. 1830/2003 of the European Parliament and of the Council concerning the traceability and labelling of genetically modified organisms and the traceability of food and feed products produced from genetically modified organisms require the following:
- Consumers' safety has to be guaranteed as a result of the traceability of products consisting of or containing GMO's.
- All products are subject to compulsory labeling.
- Operators should transmit the following information in writing: (i) an indication that the products consist of or contain GMO's, (ii) the unique alphanumerical identifiers assigned to the GMO's contained in the products.
- Operators who place on the market a pre-packaged product consisting of or containing GMO's must, at all stages of the production and distribution chain, ensure that the words "This product contains genetically modified organisms" or "Product produced from GM (name of organism)" appear on a label affixed to or transmitted with the product.
- When placing a product on the market, the industrial operator must transmit the following information in writing to the operator receiving the product: (i) an indication of each food ingredient produced from GMO's, (ii) an indication of each raw material or additive for feeding stuffs produced from GMO's, (iii) if there is no list of ingredients, the product must nevertheless bear an indication that it is produced from GMO's.

- For food or feed products, including those intended directly for processing, traces of GMO's will continue to be exempt from the labeling obligation if they do not exceed the threshold of 0.9% and if their presence is adventitious and technically unavoidable (EUROPEAN UNION WEBSITE).

European consumer opinion is expressed and enhanced through NGO's activities. It is dominated by a negative attitude towards GM products. According to the results of several surveys the issue of genetic engineering ranks high up in the list of potential risks caused by food. Considering the above mentioned, the future of this field in Europe cannot be predicted. The resistance is very strong, so it seems that GM food will not spread the markets in the next years.

Figure 2 shows a comparison of people's opinion about different applications of biotechnology in Europe and the USA.

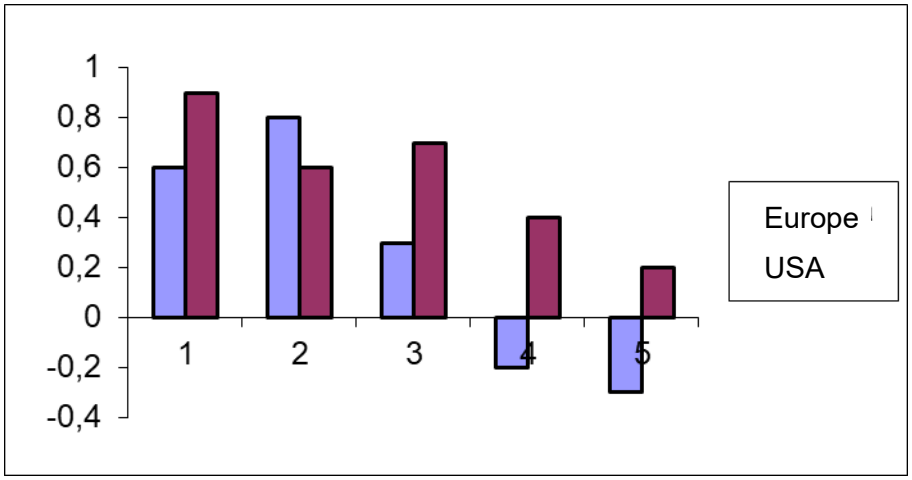

Figure 2. Approaches of the public to fields of biotechnology in Europe and the USA. 1. remedies, 2. genetic testing, 3. crops, 4. food, 5. organ transplant (acceptability of values: 1: acceptable, 0: neutral, -1: unacceptable)

GMO's in Hungary

Hungary joined the European Union on 1st May 2004. The country has moratorium in place for the commercial cultivation of GM crops that can be applied with reference to new scientific evidence for security risks. The Commissions motion to lift the Hungarian moratorium was outvoted by more than half of the Member States in September 2006. It is not easy to see the clear picture. On one side, there are opinions that most of Hungarian consumers (70-80%) do not want GMO's. These figures come from green movements and NGO's. Multinational biotechnological companies in the country state the opposite that almost three-fourth of farmers want to grow GMO's.

As it is seen, two sides are present opposite each other about the question. The 'pros' - academics interested in conducting research for multinationals and the big farmers' group both claim the right to choose - say that this kind of development in biotechnological research could place Hungarian agriculture on the top rank of the region in view of the application of the new technology. Other arguments are that energetic sector could profit from the new technology, it is environmentally friendly, high added value and many jobs could be created in regions where unemployment is a real serious problem. Their communication is a bit one-sided and neglects the resistance of consumers saying that consumers have no business defining what the product comes from.

The 'contras' are mostly politicians - there is a 5-party consensus in the Parliament -, consumers, environmental organizations, organic farmers, leading scientists from the fields of nutritional and ecological sciences. Farmers say that GMO-free status of the country would mean better prices on markets, while coexistence would result in the loss of markets; and since Hungary is an agricultural country, these losses would adversely affect its whole economy. Scientists emphasize the unnecessary and unpredictable risks of the technology.

The most debates were on the buffer zones - the separation of conventional and biotech crops. Finally, the buffer zones became 400 meters wide. This kind of strict restriction is exceptional in Europe. Not only crops but infrastructure for the two technologies would be needed to avoid contamination from treatments after harvests and the economical sources for this can be questionable (SIMONYI, 2007).

The opinion of consumers and professionals about gene technology is mostly negative and figures are a bit different but similar.

Professionals: 37.61% 'rather negative than positive', 17.95% 'predominantly negative'.

Consumers: 35.04% 'rather negative than positive', 13.25% 'predominantly negative'.

More than half (51%) of the consumers would refuse GM food even if it was cheaper, more tasty, had better appearance and longer shelf-life than the traditional one.

Labeling also seems to be very important for Hungarian consumers as mainly three-fourth of them (73%) thinks it compulsory to indicate GM content on the packages of foodstuffs.

Even if Hungarian consumers predominantly refuse GM products, this proportion is still much smaller than in Western Europe (BANATI AND SZABO, 2006).

REFERENCES

ASEBIO: Biotech crop area by country. http://www.asebio.com/documentos/d_1012_28.doc

BANATI, D., SZABO, J.A. (2006): Knowledge and acceptance of genetically modified foodstuffs in Hungary. Acta Biologica Szegediensis 50: 115.

BENBROOK, C.M. (2004): Genetically Engineered Crops and Pesticide Use in the United States: The First Nine Years. BioTech InfoNet. Technical Paper Number 7 http://www.biotech-info.net/Full_version_first_nine.pdf

BISOFA, A., DOMAKOWSKI, G., EVTIMOVA, L., GONDOVA, A., TOURILOVA, K., TRZCINKA, N. (2001): Differences in the authorization process of GMO's in the EU and the USA. EPCEM project report. http://www.leidenuniv.nl/cml/sem/projects/epcem/2001-2.pdf

BIZILY, S.P., RUGH, C.L., MEAGHER, R.B. (2000): Phytodetoxification of hazardous organomercurials by genetically engineered plants. Nature Biotechnology 18: 213.

European Union Online, Traceability and labelling of genetically modified organisms (GMO's). http://europa.eu/scadplus/leg/en/lvb/l21170.htm

FERNANDEZ-CORNEJO, J., HENDRIKS, C., MISHRA, A. (2005): Technology Adoption and Off-Farm Household Income: The Case of Herbicide-Tolerant Soybeans. Journal of Agricultural and Applied Economics 37: 549.

FERNANDEZ-CORNEJO, J., CASWELL, M. (2006): The First Decade of Genetically Engineered Crops in the United States. USDA Economic Research Service Economic Information Bulletin 11. http://www.ers.usda.gov/publications/eib11/eib11.pdf

GMO COMPASS (2008): Commercial GM Crops in EU on the rise - GM Maize: 110,000 Hectares under Cultivation. http://www.gmo-compass.org/eng/agri_biotechnology/gmo_planting/ 191.gm_maize_110000_hectares_under_cultivation.html

ISAAA BRIEF 35-2006, Executive Summary: Global Status of Commercialized Biotech/G Crops: (2006).
http://www.isaaa.org/resources/publications/briefs/35/executivesummary/default.html
List of Completed Consultations on Bioengineered Foods. U. S. Food and Drug Administration Website. http://www.cfsan.fda.gov/~lrd/biocon.html
MEAGHER, R.B. (2000): Phytoremediation of toxic elemental and organic pollutants. Current Opinion in Plant Biology 3,153 (2000), Corrigendum: Current Opinion in Plant Biology 3: 435.
MENDEZ, M.O., MAIER, R.M. (2008): Phytostabilization of mine tailings in arid and semiarid environments - an emerging remediation technology. Environmental Health Perspectives 116: 278.
PEPO, P., ERDEI, E., KOVACSNE OSKOLAS, H. (2005): Genetically modified organisms (GMO's) in Hungary. Journal of Agricultural Forum 16: 5.
PEPO, P. (2006): Some additions to the coexistence of conventional, bio- and GM production in Hungary (In Hungarian). Journal of Hungarian Academy of Sciences 167: 484.
PHIPPS, R.H., PARK, J.R. (2002): Environmental benefits of genetically modified crops: Global and European perspectives on their ability to reduce pesticide use. Journal of Animal and Feed Science 11: 1.
PUSZTAI, A., BARDOCZ, S., EWEN, S.W.B. (2003): Food safety: Contaminants and Toxins, editor: D'Mello, J.P.F., Chapter 16: Genetically Modified Foods: Potential Human Health Effects, CAB International.
SIMONYI, B. (2007): Academics contra Deputies - GMO war in Hungary.
http://www.vedegylet.hu/modules.php?name=News&file=article&sid=568
Vienna Declaration for a GMO-free Europe.
http://www.ifoam.org/about_ifoam/around_world/eu_group/pdfs/Vienna_declaration_final_version_30-03-06.pdf
WHITMAN, D.B. (2000): Genetically Modified Foods: Harmful or Helpful? CSA Discovery Guides. http://www.csa.com/discoveryguides/gmfood/overview.php

Review on Agriculture and Rural Development 2017 vol. 6 (1-2) ISSN 2063-4803

ANTIOXIDANT AND ANTIMICROBIAL ACTIVITY OF HERBAL TEAS

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ABSTRACT
Teas made from 18 Hungarian medicinal plants were investigated for their total phenolic content and antioxidant effect as radical scavenging activity using the Folin-Ciocaltau and DPPH assays. Antimicrobial effect of the herbal teas was measured by agar diffusion method.
In total, the results showed that the smallflower hairy willowherb (*Epilobium parviflorum*) had the highest antioxidant effect among the plants studied. Teas made from fennel (*Foeniculum vulgare*) and bean pods (Phaseoli legumen) have the lowest activity. Only four herbal teas showed some antimicrobial activity: the smallflower hairy willowherb (*Epilobium parviflorum*), common agrimony (*Agrimonia eupatoria)*, spearmint (*Mentha crispa*) and bean pods. At smaller concentrations the relationship found between total phenolic content and radical scavenging activity was linear but with increasing phenol content the antioxidant activity remained the same.

Keywords: medical plants, antioxidant activity, antimicrobial activity, aqueous extract, total phenols

INTRODUCTION

Oxidative stress plays an important role in the development of cancer and heart diseases. Antioxidant compounds of plants can help to protect our health from oxidative damage. Polyphenols found in medical plants, work as naturally antioxidants (AOSHIMA ET AL., 2007; CONDRAT ET AL. 2009). Herbs are also a rich source of antimicrobial agents (SOUZA ET AL., 2005). In this study teas made from 18 Hungarian medicinal plants were investigated for their antioxidant and antimicrobial activity. The goal was to find a relationship between the total phenol content and the antioxidant capacity, as well as to compare results of the antioxidant and antimicrobial measurements.

MATERIAL AND METHOD

Plant materials

The following dried Hungarian herbs were purchased from a Hungarian grower: Bean pods (*Phaseoli lengumen*), Black elder (*Sambucus nigra*) – flowers, Buckthorns (*Frangula alnus*) – cortex, Celery (*Apium graveolens*) – leaves, Common agrimony (*Agrimonia eupatoria*) – aerial part of the plant, Common chicory (*Cichorium intybus*) – aerial part and roots, Dandelion (*Taraxacum officinale*) – leaves and roots, European dewberry (*Rubus caesius*) – leaves, Fennel (*Foeniculum vulgare*) - fruit, Field horsetail (*Equisetum arvense*) – aerial part of the plant, Hedge bedstraw (*Galium mollugo*) – aerial part of the plant, Lemon balm (*Melissa offininalis*) – leaves, Maize silks (*Maydis stigma*), Smallflower hairy willowherb (*Epilobium parviflorum*) – aerial part of the plant, Small-leaved lime (*Tilia cordata*) – leaves, Spearmint (*Mentha spicata*) – leaves, Yellow bedstraw (*Galium verum*) – aerial part of the plant, Yellow sweet clover (*Melilotus officinalis*) – aerial part of the plant.

Test organisms and media
Gram-positive bacteria: *Bacillus cereus* and *Bacillus subtilis*
Gram-negative bacteria: *Escherichia coli* and *Pseudomonas putida*
Yeasts: *Saccharomyces cerevisiae* and *Geotrichum candidum*
Molds: *Aspergillus niger, Penicillium chrysogenum, Fusarium spp*.
The Gram-positive bacteria were cultured on Tryptone Glucose Yeast Extract Agar (TGE), the Gram-negative bacteria on Luria-Bertani (LB) medium, and yeasts and molds on Malt Extract Agar (MEA).

Brewing herbal teas
Herbal teas were prepared by addition of 200 ml boiling distilled water to 2 g of dried herbs. After 20 min incubation teas were filtered through filter paper, cooled to room temperature and used for the chemical analysis. A small volume of the teas (5 ml) was sterile filtered through a membrane filter (0.45 μm) and stored in a refrigerator until the antimicrobial tests were done.

Determination of total polyphenols (TP)
TP was determined by the Folin-Ciocalteu assay. After the appropriate dilution 1 ml of the tea was mixed with 1 ml ethanol (96 v/v%), 5 ml distilled water and 0,5 ml of Folin-Ciocalteu's reagent (50 %). After 5 min, 1 ml of aqueous sodium carbonate solution (5 %) was added to the mixtures and were incubated at room temperature in dark for 1 hour. The absorbance was measured at 725 nm by an UV/VIS spectrophotometer (Philips PU8740). For the calibration curve gallic acid solution (50 μg/ml) was used. The polyphenol concentration was expressed in mg gallic acid equivalent (GAE)/g dried herb (AOSHIMA ET AL., 2007; MILIAUSKAS ET AL., 2004).

Determination of DPPH radical scavenging activity
In the assay 5-fold dilutions of herbal teas were used. Three ml of 100 μM DPPH (2,2-diphenil-1-picrylhydrazil) solution was added to 0.5 ml of the diluted samples and these mixtures were incubated in dark at room temperature for 30 min. To the control, instead of the tea sample, 0.5 ml ethanol was added. After 30 min changes in color (from violet to yellow) were measured at 517 nm. Radical scavenging activity was calculated by the following equation:
DPPH• scavenging activity (%) = $((A_c - A_s)/A_c) \times 100$,
where: A_c was the absorbance of the control sample and A_s was the absorbance of the tea sample (MILIAUSKAS ET AL., 2004; AOSHIMA ET AL., 2007).

Determination of antimicrobial activity
The agar well diffusion assay was used. One ml of 18-22 h old suspensions of bacteria and yeasts, and 0.1 ml of spore suspension of 72 hours old mold cultures (the spores from the agar were washed with 10 ml sterile distilled water) were seeded on the appropriate medium by the spread plate method. After drying, three 8 mm wells were prepared by a sterile cork-borer. Then 0.1 ml of each tea was added into the wells. Streptomycin (bacteria) and nystatin (yeasts and molds) were used as positive control and sterile distilled water as negative control. The plates were incubated at appropriate temperatures for 24 h. The antimicrobial effect was determined by measuring the diameter of the inhibition zones (PAREK AND CHANDA, 2007; MAHESH AND SATISH, 2008).

RESULTS

The highest polyphenol content and antioxidant activity was measured in smallflower hairy willowherb tea (83.45 mg GAE/g dried herb and 83.9 %) followed by dewberry leaf tea. Teas made from fennel (1.95 mg GAE/g and 2.1 %) and bean pods had the lowest activity (*Figures 1* and *2*). Linear relationship was found between total phenol content >20 mg GAE/g and DPPH scavenging activity but at higher phenol content the radical scavenging activity didn't changed showing saturation (*Figure 3*).

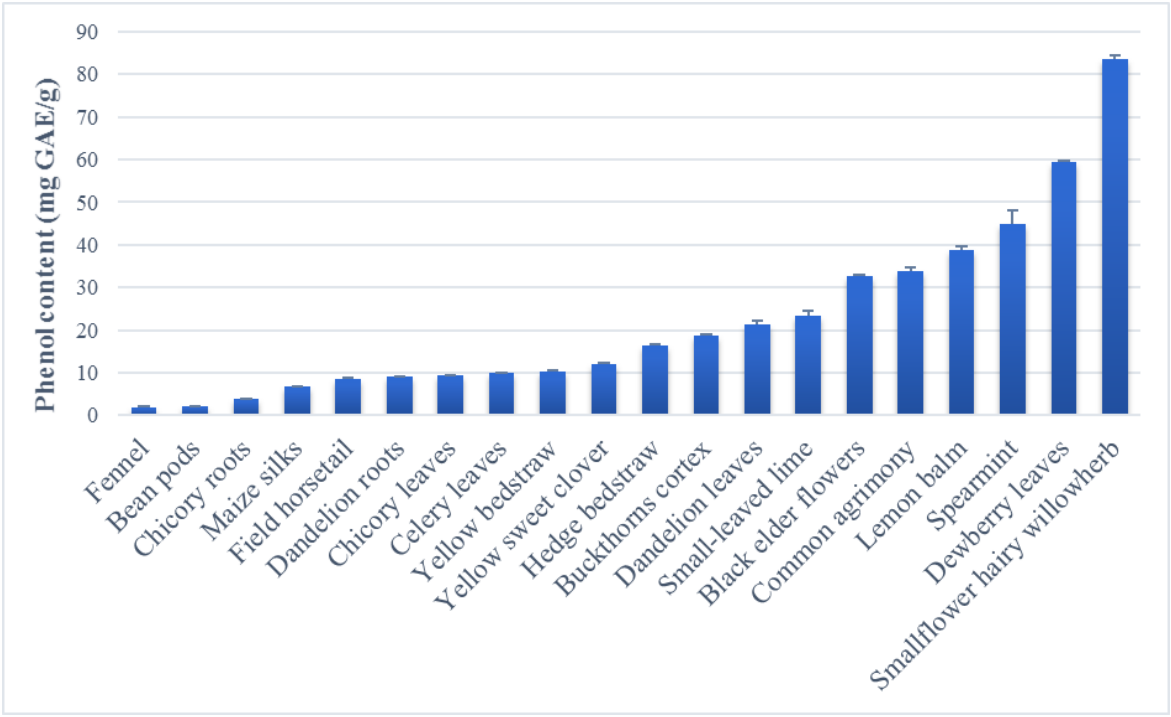

Figure 1. Total phenol content of the investigated herbal teas

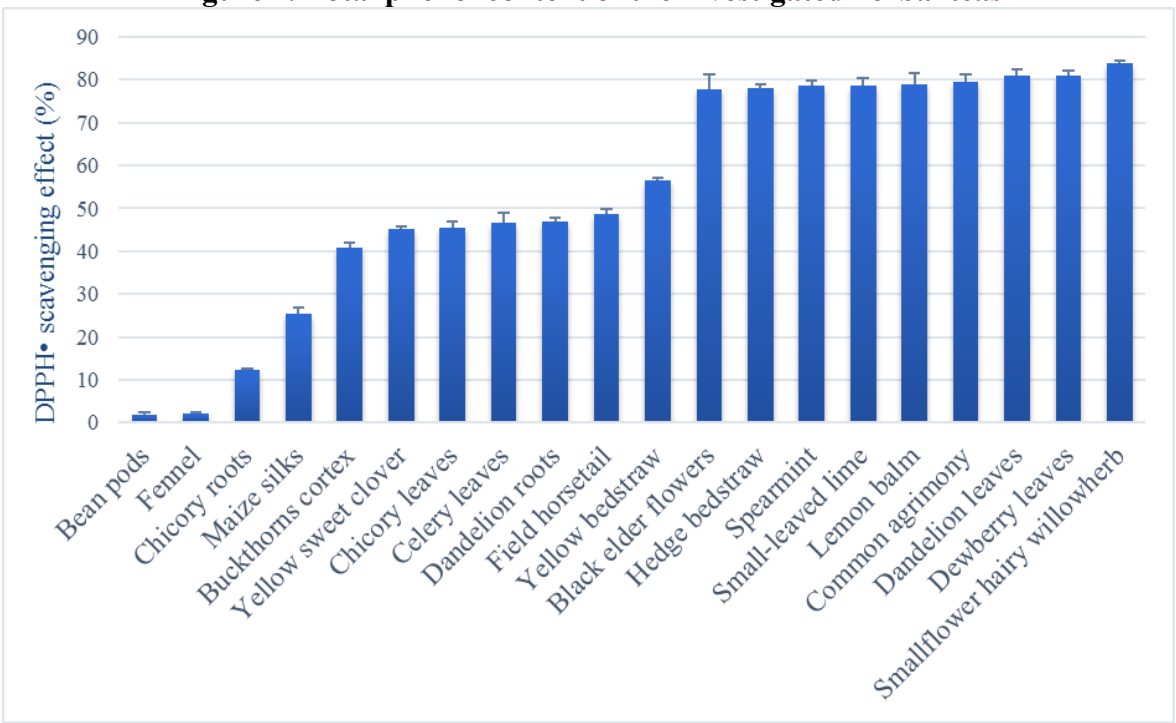

Figure 2. DPPH radical scavenging activity of the investigated herbs

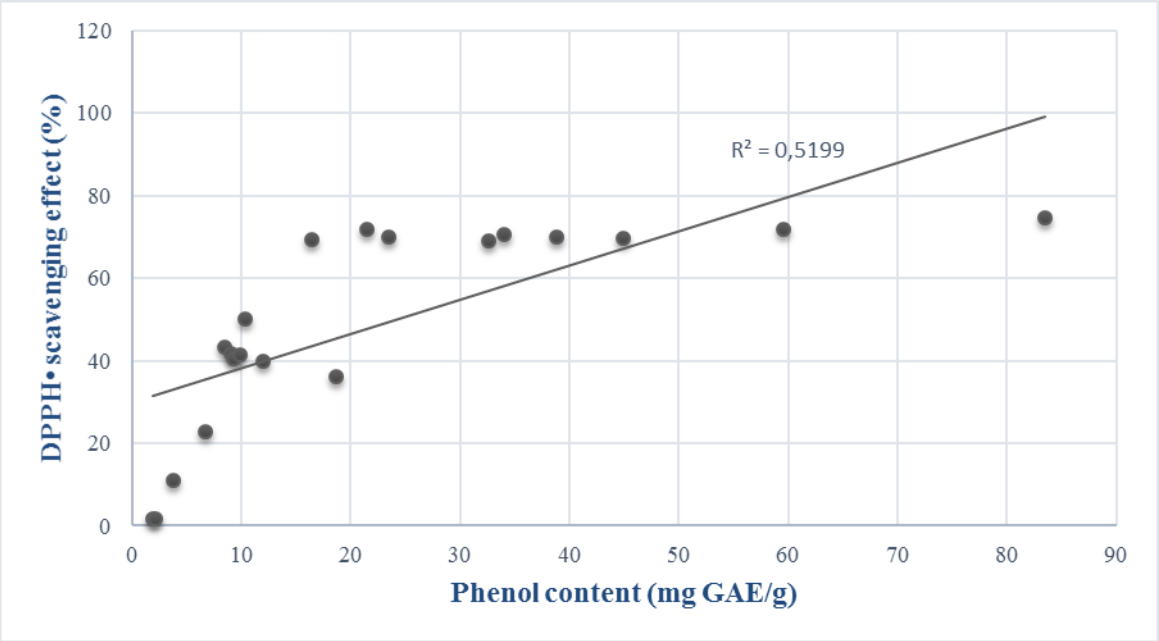

Figure 3. Relationship between radical scavenging activity and total phenol content

Only four teas showed some antimicrobial activity: the smallflower hairy willowherb on *B. subtilis (*inhibition zone (IZ) 12 mm), and *P. putida* (IZ 14 mm), common agrimony on *B. cereus* (IZ 12 mm), bean pods also on *B. cereus* (IZ 11 mm) and spearmint on *B. cereus* (IZ 9.33 mm). None of the herbs studied showed antifungal activity.

DISCUSSION

Our results show that there are large differences in the total phenol content of herbal teas, but half of the investigated herbs showed excellent antioxidant effect with about 80 % radical scavenging activity. It possibly means that not only phenols are responsible for the antioxidant effect; other heat stable agents play also a role. Considering the antimicrobial activity, probably a more concentrated tea or ethanol extract would be more effective. In total, the results showed that, in herbal teas different compounds could be responsible for the antioxidant and antimicrobial activity. Teas made from Hungarian herbs, in addition to the other beneficial effects, are great sources of antioxidants.

ACKNOWLEDGEMENTS

Lilla Barbara Kincses thanks for her personal ÚNKP-16-1 grant.

REFERENCES

AOSHIMA, H., HIRATA, S., AYABE, S. (2007): Antioxidative and anti-hydrogen peroxide activities of various herbal teas. Food Chemistry 103: 617–622.
CONDRAT, D., SZABO, M-R., CRISAN, F., LUPEA, A-X. (2008): Antioxidant activity of some phanerogam plant extracts, Food Science and Technology Research 15 (1): 95-98.

MAHESH, B. AND SATISH, S. (2008): Antimicrobial activity of some important medicinal plant against plant and human pathogens. World Journal of Agricultural Sciences 4(S):839-843.

MILIAUSKAS, G., VENSKUTONISA, P.R., VAN BEEK, T.A. (2004): Screening of radical scavenging activity of some medicinal and aromatic plant extracts. Food Chemistry 85:231–237.

PAREKH, J., CHANDA, S. (2007): Antibacterial and phytochemical studies on twelve species of Indian medical plants. African Journal of Biomedical Research 10:175-181.

SOUZA, E.L., STAMFORD, T.L.M., OLIVEIRA LIMA, E., TRAJANO, V.N., FILHO, J.M.B. (2005): Antimicrobial effectiveness of spices: an approach for use in food conservation system. Brazilian Archives of Biology and Technology - An International Journal, 48(4): 552-553.

Review on Agriculture and Rural Development 2017 vol. 6 (1-2) ISSN 2063-4803

THE HISTORY OF AGRICULTURAL EDUCATION IN HUNGARY AND CURRENT PARTICIPATION TRENDS IN AGRICULTURAL STUDIES

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ABSTRACT
The contribution of agriculture to the GDP in Hungary is higher than the European average. Consequently, agriculture plays an important role in the Hungarian economy. However, the overall productivity of this sector is still a fraction of those in some Western European countries. According to some economists, this is due to the inadequate number of skilled manpower and the poor supply of agricultural professionals. It is often said, which has also been shown by a number of research studies, that agricultural credentials are not particularly appealing to young people due to the generally reputed low prestige attached to this field. In this paper, I investigate whether the number of participants in secondary level and higher level agricultural education has indeed been declining and how this trend relates to the demographic characteristics of Hungary. I intend to highlight whether the relatively low productivity of the agricultural sector can be rightfully explained, amongst other factors, by the low number of skilled workers and the insufficient supply of agriculture graduates.

Keywords: agricultural education, demography, productivity, output increase

INTRODUCTION

In Hungary, agriculture contributes approximately 4% to the GDP, which is slightly higher than the European average. When other sectors which depend directly on agriculture are also taken into account, this ratio increases to 10-12%.
Alongside tourism, the only sector that demonstrates a positive financial balance in foreign trade is agriculture, which indicates its importance within the Hungarian economy. In 1999, a total of 275,000 people were employed in agriculture, forestry and fishing together. In 2005, this number dropped to 194,000 and in 2008, employment figures declined further to 174,000 (HANTOS, 2010). The fact that the agricultural society is aging only adds to this problem. A staggering 31% of farmers are over 65 and the average age is 56 years (LACZKA, 2014). Young people's interest in agriculture has been deteriorating year-over-year. A survey conducted among undergraduates suggests that a degree in agricultural studies is simply not popular with this group and the social status and prestige associated with agriculture is considered low. People commonly link agriculture with manual labour, however, the competitiveness of this sector and gaining access to EU funding require profound knowledge in economy and finances while precision farming requires a high degree of technical skills. Consequently, professionals in agriculture need to possess a broad range of knowledge and expertise nowadays.
Arguably, young people ought to learn the basics of these specific areas at school. Hungary has played a pioneering role in the field of agricultural education in Europe. The first elementary school teaching agricultural studies was founded in 1779 by Szorgalmatossági Tessedik Samuel Lutheran pastor under the name of Practical School of Economics in Szarvas.
According to LÁZÁR (2015), non-urban areas are expected to deteriorate and become impoverished if the capacity of agriculture to support the population does not increase. Agricultural education is the key factor for the development of this sector and its main

objective is to equip students with current theoretical and practical knowledge, which are also internationally competitive. Furthermore, it should also provide the agricultural workforce with training opportunities in order to learn about new technology, regulations and gain up-to-date market information (KSH, 2015).

MATERIAL AND METHOD

For all of my analyses and comparisons I have used secondary information and data which I have obtained from publicly available sources. The information about the school-age population and the number of participants in secondary level agricultural studies have been gathered from the databank found on the website of the Hungarian Central Statistical Office (KSH), while the information about the number of students admitted to higher education in agriculture has been collected from the statistics found on the Education Office`s website (felvi.hu). Having compiled the relevant data, my first step was to create column charts using Excel. Subsequently, I generated trend lines which helped me visualise the general course of the dataset. Finally, I reached my own conclusions on the basis of these results and findings of other prior studies on this topic.

RESULTS

Numerous studies have accounted for the drastic drop in the number of participants in agricultural education in Hungary. This suggests that Hungarian agriculture has virtually no chance to gain on more developed countries where agricultural output is significantly higher. Due to the low prestige associated with this sector, only around 6% of all participants in higher education pursue agricultural studies (MÉSZÁROS, 2014). As a matter of fact, 6% may appear a very low percentage indeed. However, we must also consider whether this rate has ever been any higher in previous years, and if so, then by how much. For this analysis, I have looked at the number of students admitted to higher education in agriculture as opposed to the number of participants in higher education as a whole. This way, I intend to demonstrate the true notion of agriculture and its progress over time. I have obtained the relevant data from the publicly accessible online admission procedure and information databank operated by the Education Office (FELVI.HU).

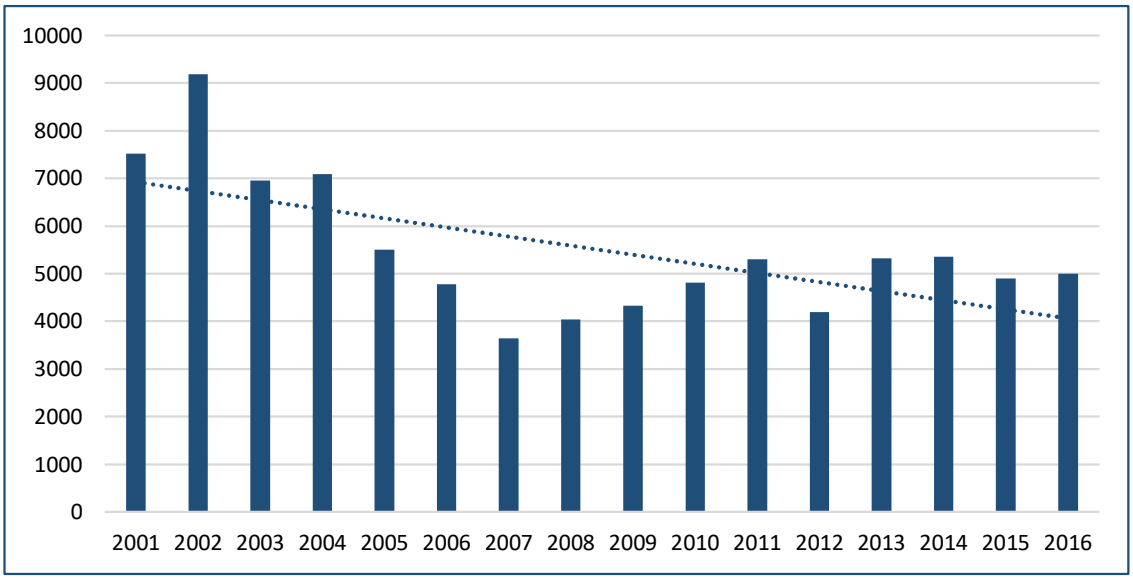

Figure 1. Number of students admitted to agricultural higher education
Source: felvi.hu

The analysis of the annual figures from 2001 and a trend line placed over the dataset clearly indicate a decline in admission numbers over the subject period. A closer examination - without the trend line - shows that the fall has bottomed out and admission numbers have been stagnating since 2010.
In all sectors, including agriculture, there is always a need for lesser qualified personnel. This is perhaps even more typical in agriculture therefore I have investigated the number of participants in secondary-level education. This information has been collected from the database of the Hungarian Central Statistical Office (KSH). The dataset includes apprenticeship training in a more traditional sense as well as agricultural training and education provided in vocational schools and other institutions.

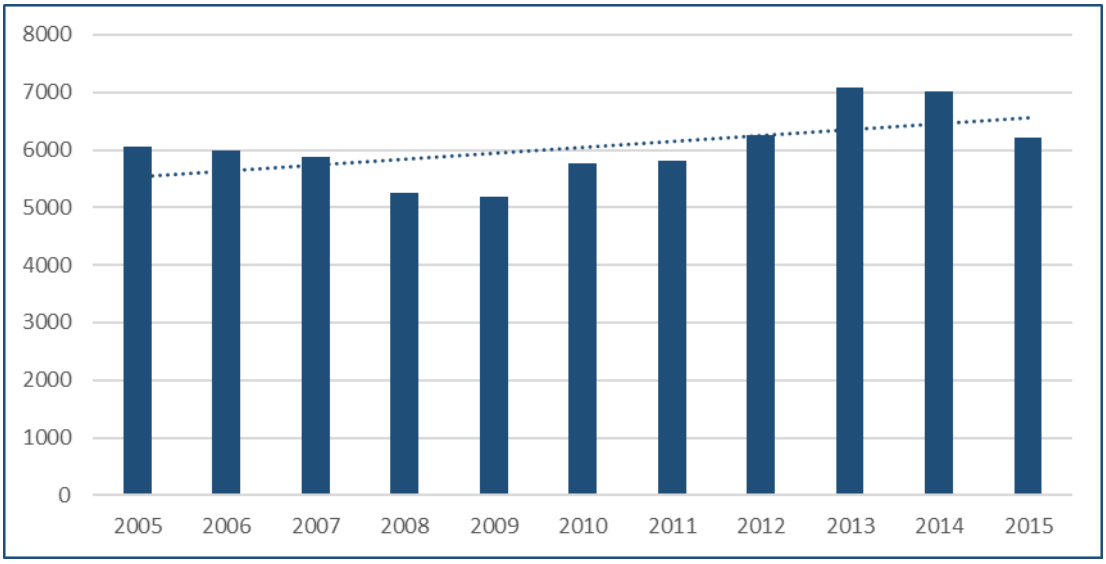

Figure 2. Number of students in secondary education
Source: KSH

The above chart illustrates that despite smaller fluctuations, the number of participants in secondary-level education in agriculture has been more or less constant over the past ten years. On closer inspection of the trend line, one might suggest that these numbers are showing an upward movement. However, considering the demographic characteristics of Hungary this conclusion would be inaccurate and short-lived at best.

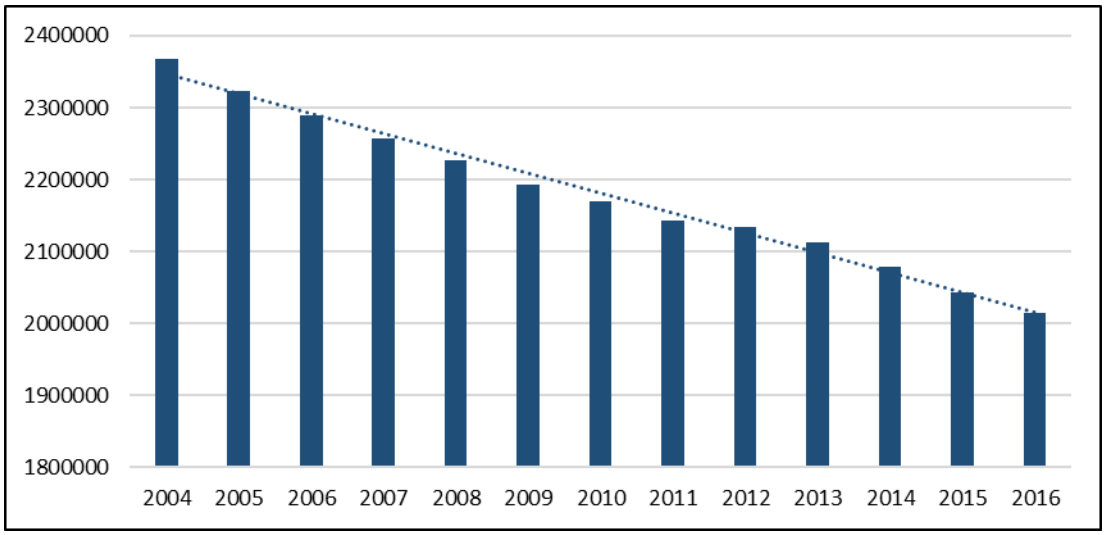

Figure 3. School-age population
Source: KSH

Demographic data has been gathered from the KSH database in order to evaluate the changes in the school-age population in Hungary. On the basis that the number of school-age residents has been falling, it would not be reasonable to expect the number of participants in secondary-level education to rise. It would be a spectacular result if the latter stagnated in future periods. Arguably, this could only be achieved with the detriment to other sectors.

CONCLUSIONS

Understanding the demographic characteristics of Hungary, even if the level of prestige associated with this sector improves, the number of participants in agricultural education cannot be expected to increase. Some people believe that working in agriculture provides them with a good earning potential and there is always a need for well-educated and skilled professionals both in Hungary and abroad, which suggests promising future employment opportunities (TRESÓ, 2015). This aspect should be communicated to students so that application numbers for higher education does not continue to fall. It is important to remember that graduating from agricultural studies does not necessarily lead to a long-term career choice in this sector. The government should subsidise the purchase of new machinery and equipment while facilitating the spread of more modern technology. This could be achieved by offering free of charge or subsidised training opportunities for agricultural workers. I believe that one way to revitalise the aging agricultural sector is to encourage the passion of young farmers together with the implementation of an effective, thoughtful and step-by-step generation change. In order for this to be successful, we need to reconsider the environmental aspects of the region, revisit traditional practices in agriculture and establish a suitable incentive system.

REFERENCES

HANTOS, K. (2010.): Hatékony generációváltás elősegítése a mezőgazdaságban -A fiatal gazdák támogatása-Budapesti Corvinus Egyetem Tájépítészeti és Tájökológiai Doktori Iskola (PhD) disszertáció pp.31.

KSH (2015): A mezőgazdasági képzettségűek társadalmi jellemzői.

LACZKA, É. (2014): KSH elnökhelyettes előadás AGRYA és Második Hullám Vidéki Ifjúsági Szövetség közös konferenciáján

LÁZÁR, J. (2015): Miniszterelnökséget vezető Miniszter Makói Nemzetközi Hagyma és Gasztronómiai Fesztivál Mezőgazdasági fórumbeszéd

MÉSZÁROS, S., SZABÓ, G. (2014): Hatékonyság és foglalkoztatás a magyar mezőgazdaságban Gazdálkodás 58. évfolyam 1. szám

TRESÓ, I. (2015): K&H Agrárfejlesztési főosztály vezetője Országos Statisztikai Adatgyűjtési Program interjú Agrárszektor

Review on Agriculture and Rural Development 2017 vol. 6 (1-2) ISSN 2063-4803

MATERIAL STOCKS AND FLOWS OF EXTENSIVE CATTLE PRODUCTION

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ABSTRACT
The current climate change and population boom is the result of the technical developments that aroused by the industrial revolution and the Second Word War. The food shortage arising from that steadily increase poses several problem for agriculture which is exacerbated by the ineffectual operation of the food processing industry. To cover the required amount of food leads higher greenhouse gas emission than CO_2 like CH_4 and N_2O. Considering this fact I kept it important to find a solution that can be inserted in our countries facility and which is independent from soil usage.
The importance of the cattle breeding sector is that it doesn't require those agricultural lands which could also serve human's need.
I will examine the impact of the extensive cattle with material flow analysis, which is able to show the flows of the specific materials in a given place and in a given time. This calculation is not used count with the pollution and economic factors of the materials.
According to my survey the results show that the examined farms needs 4,72; 4,64; 0,24 kg of material stock per one kg of meat to maintain the production. This production needs average 10-13 kg of dry matter input, of which major content is grass. As an unintended emission CO_2 emission is also generated: The generated amount of CO_2 depends on the Farm structure: in average 11,32; 16,02; 16,76 kg CO_2 / meat kg.
To make comparable results it demands weighted averages. That means to make material flow analysis result like feed intake and CO_2 emission needs to be weighted with the time which is needed for the production.
It can be claimed that the total CO_2 emission of an adult cattle is over 30 kg per one kg of meat, and there are no methods to decrease it. But on the other hand the usage of stocks can be reduced by different methods.
The first is the number of the livestock could be increased because it will also increase the efficiency of natural resource usage. On the other hand we can help the farms to co-operate with each other. It allows them to share their stocks. And the last solution is to make multifunctional farms which can produce plants and animals at the same time.
Despite of the high rate of productions' CO_2 emission it is still competitive against intensive cattle, owing to the low rate of natural resource requirements

Keywords: carbon dioxid, green house gas, material stock, material flow, climate change

INTRODUCTION

The current climate change and population boom is the result of the technical developments that aroused by the industrial revolution and second word war.
The new technologies made it possible for the population to increase steadily. It led the first doubling of the population by 1959. The population was around 3 billion in that time and in the present over 7 billion (WORLDOMETERS, 2016). The food shortage arising from that steadily increase poses severe problem for agriculture which is exacerbated by the ineffectual operation of the food processing industry (POPP, 2011). One of the reason is wasting. The 30% of the food goes to waist without processing (TEISLE, 2011).
According to estimates the demand for food will have increased by 60% percent demand for energy will increased 70% which is produced by the 30% population increase (POPP, 2011).

Meat production requires higher amount of fodder, which can be explained by the living organisms' low metabolic efficiency. Animals can utilize only average 10% of their feed. Because of the above mentioned losses the rate of crops will increase. On the other hand humans could use that to feed people (THYLL, 1996).
Nowadays 70% of global soil is used for the production of animal feed. It is used up by intensive farming methods of cattle, swine and poultry (CHEMNITZ ET AL., 2015). Considering the fact that the intensive livestock need less feed they will have fewer greenhouse gas emission than the extensive ones (GARNETT, 2010). Opposite to that the feeding of these animals mean more intensive of soil usage that cause higher erosion of agriculture land (CHEMNITZ ET AL., 2015).
In my opinion the cut of the ever increasing production of crops could be achieved by extensive cattle ranching.
However, in the last 15 years the production was cut back, there are different reasons for the increase the number of cattle.

- According to estimates the food consumption will increase
- In the form of food processing has untapped potential (NÁBRÁNDI ET AL., 2008).

There will be less meat produced in the case of extensive cattle ranching compared to the intensive cattle ranching at the same time there will be less demand for feed. It can successfully use the weaker quality pastures that would be impossible to use for agricultural production. If we examine the green-house gas emission per capita it is much more efficient than intensive farming. At the same time if we examine the production of meat per capita it is much more polluting (GARNETT, 2010).
It provides jobs for more people and helps rural development and population retains rural population (MÁRTON, 2003).

MATERIAL AND METHOD

My study is based on primary and secondary information. During the collection of secondary information the special searching function of the searching engines like google have been used. All data were collected in microsoft excell.
To determine the animal unite an online calculator was used (I7). So the weight of the calves were taken to 200 kg the weight of the young cattle were taken to 300 kg and the weight of the cattle were taken 500 kg/animal. The age of the calves were taken to 0.5 year old the age of the young cattle were taken to 2 years old and the age of the waste production were taken to10 years old.
The rate of the cattle's meat ration was taken for 65% of the total weight (KOVÁCS, 2002).
The amount of emitted CO_2 was calculated by the information of (I1) document and for a more precise data in the case of diesel oil I used (I2) online calculator.
The data needed for transporting like fuel consumption was found on websites. It was calculated with a 35 l/km of fuel consumption (I3) and a maximum 35 number of transportable cattle (I4).
All of the visited Farms sold their production to Turkey. To determine the 2050 km of estimated distance between Hungary and Turkey the google map was utilized. (I6).
During the determination of the building's weight in every cases with 10 cm of wall width, 4 meters of inner height was calculated. In the case if the wall lengths were unknown the results were calculated with equal sides.

The animal feed was grass in every cases. For the results it is important to know that an adult cattle needs 10 kg of forage in dry matter content in each day (SZATAI, 2007). That will be resulted the CO_2 emission.
All the important physical data (for example density) were downloaded from the same website (I5).
My research was conducted with a MFA (Material Flow Assessment).

2.1 Material Flow Assessment

MFA based on the balance of the material's flows. It can compare the input and the output of a process. After balancing the input and output side of the process the loss of the material flows will be visible. (BRUNNER AND RECHBERGER, 2004).
It shows the flows of the specific materials in a given place and in a given time. This calculation is not used to count with the pollution and economic factor of the materials (KYTZIA ET AL., 2004, SZABÓ, 2005).

RESULTS

Table 1. Compositions of the farms

Name of the item	I. Farm	II. Farm	III. Farm
Cow	22	35	965
Bull	1	1	54
Young cattle	13	0	569
Calf	22	35	500
Összesen	71	71	2088

Table 2. Structure of material stock

Name of the item	I. Farm	II. Farm	III. Farm
Building	37232 kg	48066 kg	53200 kg
Equipment	23628 kg	27360 kg	78560 kg
All	60860 kg	75426 kg	131760 kg

Table 3. Structure of material input

Name of the item	I. Farm	II. Farm	III. Farm
Feed	156950 kg	156950 kg	654372 kg
Fuel	1660 kg	**217045 kg**	152404 kg
Electricity	594 kg	69524 kg	11368 kg

These three tables are really important. These tables shows how effect the material stock usage (*Table 2*) and material flow (*Table 3*) usage in the size of the farms (*Table 1*). As we can see the bigger is the farm the less stock is needed. It is because buildings not necessary in the processing (*Table 2*).
And the more livestock we have the most flow it needs (*Table 3*). But it is not linear because different age group requires different amount of food (*Tables 1* and *3*).

Table 4. Structure of material Output

Name of the item	I. Farm	II. Farm	III. Farm
Livestock	**19800 kg**	**25000 kg**	**780200 kg**
Meat	12870 kg	16250 kg	507130 kg
Fuel CO_2	5000 kg	6537 kg	459050 kg
Electricity CO_2	2736 kg	3201 kg	20000 kg
Main product (animal) CO_2	198397 kg	174355 kg	8024881 kg
Unintended emission CO_2	**206220 kg**	**184093 kg**	**8503931 kg**

It is clearly visible that the older your livestock is the most weight will it result (*Table 4*) On the other hand, bigger amount of production will result a higher rate of CO_2 emission. The higher rate of the unintended emission came from the main production (*Table 4*).

Table 5. Unintended output emissions of the farms

Name of the item	I. Farm only calves	II. Farm only calves	III. Farm
CO_2 emission per one kg of livestock	8.59 kg CO_2/animal kg	8.6 kg CO_2/animal kg	35.22 kg CO_2/animal kg
CO_2 emission per 1 kg of meat	13.21 kg CO_2/meat kg	13.23 kg CO_2/meat kg	54.19 kg CO_2/meat kg
CO_2 emission per 1 kg of meat (with slaughter)	13.249 kg CO_2/meat kg	13.26 kg CO_2/meat kg	54.21 kg CO_2/meat kg
CO_2 emission per 1 kg of meat (with slaughter and transporting)	13.63 kg CO_2/meat kg	13.51 kg CO_2/meat kg	54.32 kg CO_2/meat kg
CO_2 emission per 1 kg of meat (with transporting)	13.6 kg CO_2/meat kg	13.48 kg CO_2/meat kg	54.19 kg CO_2/meat kg

CO_2 emission also depends on the age of the livestock. In this case smaller farms had lower emission per meat because of the higher rate of young calves (*Table 5*). Bigger companies have more older cattle and waste production.

Table 6. Material Flow Analysis of the Farms

Name of the item	I. Farm only calves	II. Farm only calves	III. Farm
Stock	4.72 kg/kg	4.64 kg/kg	0.24 kg/kg
Input	12.37 kg/ meat kg	9.83 kg/ meat kg	13.22 kg/ meat kg
Output (CO_2)	16.02 CO_2 kg/ meat kg	11.32 kg CO_2/ meat kg	16.76 kg CO_2/ meat kg

The results show that a bigger company has a better stock efficiency than smaller one. The biggest farm requires 20 times less stock than the smallest one.

Table 7. Overall CO_2 emission of the Farms

Name of the item	Value
I. Farm	31.72 kg CO_2/ meat kg
II. Farm	31.76 kg CO_2/ meat kg
III. Farm	32.61 kg CO_2/ meat kg

Every kilogram meat of average 3 years old 500 kg cattle contains up to 30 kg of CO_2 (*Table 7*).

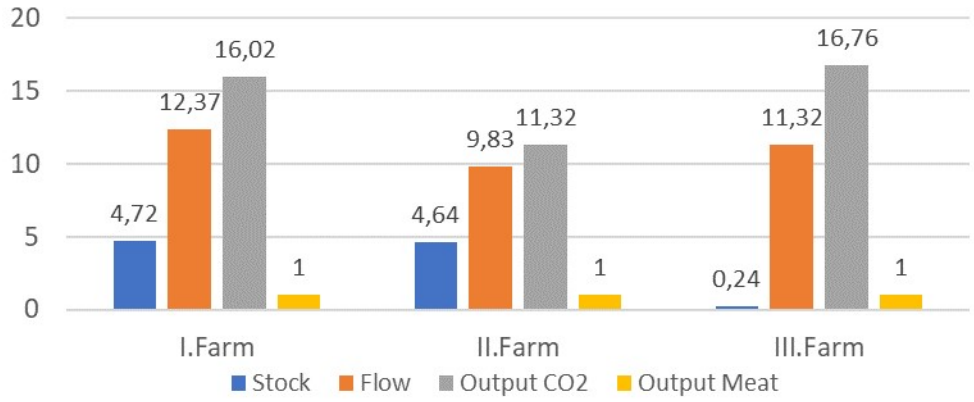

Figure 1: Result of the material flow analysis

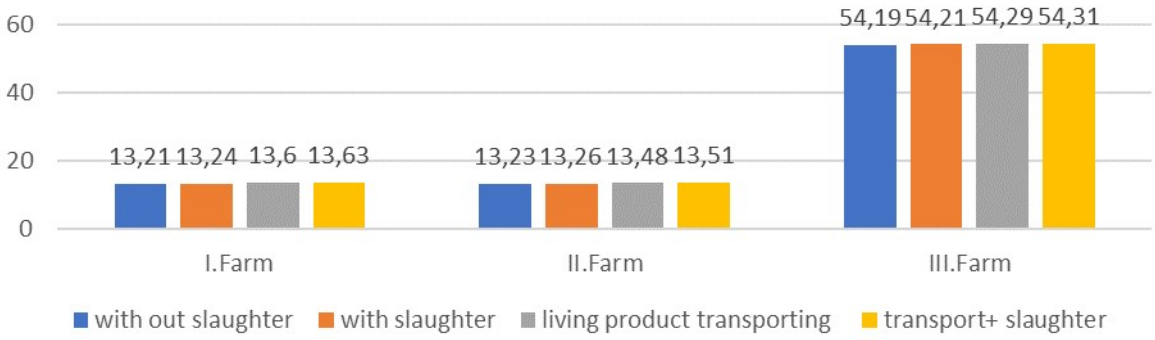

Figure 2: The additional CO_2 emission caused by added value

It can be claimed that the added value cause extra CO_2 emission but it won't increase the main productions' emission dramatically (*Figure 2*).

CONCLUSIONS

It can be claimed based on my results that the main production's unintended CO_2 emission during the transporting and the processing is not growing radically. It is because the extra CO_2 emission surplus caused by the added value is minimal comparing it to the main production. Nevertheless, it is possible because of the efficient transporting and processing systems.

During the MFA process it was determined that 0.24-4.72 kg of stock needed to produce 1 kg of meat. This value is based on the size of the farms. The bigger is a farm the lower material is needed to produce the same level of the wanted production.

If the combination of the stock examined in the case of the small farms, it can be concluded that the weight of the building is bigger than the weight of the tools. But in a bigger company it is opposite down. However, it is because production can be separated from buildings.

In the case of the biggest farm (III. Farm) it is clearly visible that the usage of the materials is more efficient than in the case of a smaller one. Therefore, because the number of livestock is 36 times bigger than in the smallest farm, while the weight of the stocks

between the two company (I. Farm and III. Farm) is only double. Nevertheless, the reason is because distribution of the tools will be better in the case of the bigger farm.
As the results presented small farms (I. Farm and II. Farm) are using relatively higher rate of tools because they are over-guaranteed.
There are three solutions to decrease the number of used materials. The first is: the number of livestock should be increased to gain the efficiency. On the other hand, farms should co-operate with each other. It allows them to share their stocks. And the third solution is to make multifunctional farms which can produce plants and animals at the same time.
During my study it was also determined that an adult animal releases up to 30 kg of CO_2 emission per each 1 kg of meat. This result is completely covered by the literature (MACDIARMID ET AL., 2016). This number is higher than in the case of an intensive cattle. In that case the emission is nearly 3 times less:12 kg CO_2/ meat kg (MACDIARMID ET AL., 2016). But the intensive cattle can perform this result, only in the case when we use soil to produce feed instead of food. Therefore, it takes soil from the agriculture.

ACKNOWLEDGEMENTS

This work was supported by the National Research, Development and Innovation Office – NKFIH, K-115851

REFERENCES

(I1): (dr. Víg András) CO_2 számítás http://energia.salgopc.hu/?wpfb_dl=119 (downloaded: 01.10.2016)
(I2): (CO_2 kalkulátor) http://www.sunearthtools.com/ (downloaded: 05.10.2016)
(I3): fogyasztásahttp://totalcar.hu/tesztek/haszon/2010/05/27/ket_napig_a_csucson/ (downloaded: 02.10.2016)
(I4): (szarvasmarha szállítás) http://zaol.hu/gazdasag/elo-allat-a-kamionban-1486247
(I5): (I2): anyag sűrűségek http://mek.niif.hu/00000/00056/html/083.htm (downloaded: 02.10.2016)
(I6):https://www.google.hu/maps/dir/T%C3%B6r%C3%B6korsz%C3%A1g/Magyarorsz%C3%A1g/@42.9449665,22.8636833,6z/data=!3m1!4b1!4m13!4m12!1m5!1m1!1s0x14b0155c964f2671:0x40d9dbd42a625f2a!2m2!1d35.243322!2d38.963745!1m5!1m1!1s0x4741837bdf37e4c3:0xc4290c1e1010!2m2!1d19.503304!2d47.162494 (downloaded: 02.10.2016)
(I7)
http://www.gazdavilag.hu/index.php?option=com_content&view=article&id=67&Itemid=12 (downloaded: 02.10.2016)
BRUNNER, P., RECHBERGER, H. (2004): Practical handbook of material flow analysis. Lewis Publisher ISBN 00-203-50720-7
CHEMNITZ, C., BECHEVA, S. (2015): Húsatlasz 1091 Budapest, ISBN 978-963-9802-07-0 ORIGINAL: ISBN 978-80-906270-0-0
KOVÁCS, T. (2002): Marhahús termelés és feldolgozás aktuális gazdasági kérdései. Mosonmagyaróvár 2002
KYTZIA, S., FAIST, M., BACCINI, P. (2004): Economically extended—MFA: a material flow approach for a better understanding of food production chain. Journal of Cleaner Production 12: 877–889 p.
MÁRTON, I. (2003): A húsmarha tenyésztésének és tartásának gyakorlata. Szaktudás Kiadó, Budapest, 122 p., ISBN 963-9553-05-0

POPP, J. (2011): KAP-reform http://slideplayer.hu/slide/2107471/ (downloaded: 2016.01.15)
PUPOS, T., TAKÁCSNÉ, K., NÁBRÁDI, A. (2008): Üzemtan II. Szaktudás Kiadó Ház Rt., Budapest, 376 p., ISBN: 978-963-973-6924
SZABÓ, F. (2005): Húsmarhatenyésztés. Mezőgazda Kiadó, Budapest, 375 p. ISBN: 978-963-286-482-2
SZATAI, ZS. (2007): Műtrágyázatlan és műtrágyázott gyep kémiai összetétele, hozama és húsló eltartó képessége. Kaposvár
TARA, G. (2010): intensive versus extensive livestock systems and greenhouse gas emissions., FCRN briefing paper
TEISLE, M.F. (2011): Environmental concerns in food consumption.
THYLL, SZ. (1996): Környezetgazdálkodás a mezőgazdaságban. Mezőgazda Kiadó, Budapest, 417 p. ISBN: 963-9121-97-5
WORLDOMETERS (2016): http://www.worldometers.info/hu/, (downloaded: 25.01.2016)

Review on Agriculture and Rural Development 2017 vol. 6 (1-2) ISSN 2063-4803

DETECTION OF BIODEGRADATION DEGREE OF SLUDGE USING DIELECTRIC MEASUREMENT

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ABSTRACT
Pre-treatments applied before biological sludge utilization technologies aim to modify the sludge structure for enhanced disintegration degree and biodegradability. Among the thermal pre-treatments methods, microwave irradiation is suitable to degrade the polymeric structure of sludge, and to increase the solubility of organic matters. Energetic efficiency of microwave heating is mainly determined by the dielectric properties, such as dielectric constant and dielectric loss factor. Dielectric properties are influenced by the frequency, temperature; composition and consistency of irradiated material, state and bond of water etc. Therefore, physicochemical changes of sludge structure; e.g. hydrolysis of macromolecules, degradation of cell wall of microorganisms, aggregation of particles; contribute to the change of dielectric parameters, as well. In our work we investigated the correlation between the dielectric parameters and structural change and biodegradability indicators. In the case of municipal wastewater, the change of organic matter removal efficiency during wastewater purification technology at a wastewater treatment plant can be detected by the change of dielectric constant. Results related to sludge processing show, that change of organic matter solubility and aerobic biodegradability correlate the change of dielectric loss factor and dielectric constant. With the degradation of polymeric structure of sludge matrix and decomposition of macromolecules caused by thermal effects or chemical pre-treatments led to increased mobility of ions and enhanced polarization of molecules. These effects led to increased dielectric constant and loss factor, what make possible to pre-indicate the efficiency of sludge pre-treatment processes by an in line and real time measurement method.

Keywords: microwave, dielectric properties, biodegradability, sludge, wastewater*)*

INTRODUCTION

Attention to microwave heating applications is continuously growing, because of the special mechanisms of microwave irradiation for energy transfer. On the contrary of the conventional heating mechanisms, energy is delivered directly into the materials during microwave heating due to the molecular level interactions with high frequency electromagnetic field. Because of the high energy density and volumetric heating effect, microwave irradiation is suitable to achieve very short process time, and, in some cases, microwave irradiation induces special structural properties or new way for chemical reactions (KAPPE, 2004). The behavior of materials in electromagnetic field can be characterized by the complex permittivity. The complex permittivity has real part, named dielectric constant and an imaginary part, named as loss factor. Dielectric constant measures the ability of material to store the external electric field; the loss factor shows the energy absorption capability of materials. Heat generation efficiency of microwave irradiation can be given by the power dissipation which can be calculated from the strength of electric field, the frequency and the dielectric parameters, respectively (BRODIE ET AL., 2014).
Depending on the physicochemical structure and composition of processed material, and the applied frequency range, heating mechanisms of microwave irradiation is occurred by dielectric polarization and/or ionic conduction. Orientation polarization or diploes rotati on

occurs due to the reorientation of permanent dipoles in oscillating electromagnetic field (BARBA AND D'AMORE, 2012). The materials containing free electrons charge polarization can be observed caused by the modification of position of electrons, resulted in non-uniform distribution of charges. In the industrially scale used microwave frequency ranges, and mainly for high water contented materials the dipole rotation is the dominant mechanisms, but ionic dissipation phenomena can be also occurred, if ions are presented in the irradiated materials (BRODIE ET AL., 2014).

In complex structured materials both mechanisms can be determinative at the same frequency, for example if the state of water content is changed. If thermal or mechanical stress was applied cell walls can disrupt, therefore the intracellular components are released increasing the free water content. The dielectric loss factor decrease with temperature until the effects of dipoles dominates, but then start to increase due the present of ionic compounds originated from intracellular liquor. There can be found process in which ionic components are dosed to the wastewater to increase the heating efficiency of microwave irradiation. Ionic conduction can be dominant, if the ionic compounds have migration ability, for example in solutions or suspensions. If the dipolar rotation mechanisms dominated over the ionic dissipation, decreasing of dielectric property values was observed, because temperature increment increases the molecular disorder. On the other hand, due to the reduced dielectric loss factor, the penetration depth of electromagnetic waves increases (HOLTZE ET AL., 2006). When the penetration depth is lower than the half of the characteristic dimension of irradiated sample uniform heating cannot be achieved. But heat can be transferred from the heated skin layer towards the core of material by conduction or convection mechanisms. The effects of microwaves are divided into thermal and athermal effects. Thermal effects are occurred by the heat generation in material due to the absorption of microwave energy. Athermal effects mean the change of chemical, biochemical and physicochemical behavior of the materials caused by electromagnetic field without temperature change. The results related to the investigation of athermal effects are contradiction. It can be noticed, that activation energy of microwave irradiation in GHz frequency range is too low to disrupt the covalent bonds or hydrogen bonds (KAPPE, 2004).

Dielectric parameters of wastewater and sludge are not investigated in details, and there is not examined the possible relationship between the biodegradability indicators and dielectric parameters. Therefore our work focused on to determine the temperature dependency of dielectric constant of wastewater and sludge originated from municipal wastewater purification technology and food industry, respectively. Another task of research work is to investigate the correlation between the change of biodegradability and dielectric parameters.

MATERIAL AND METHOD

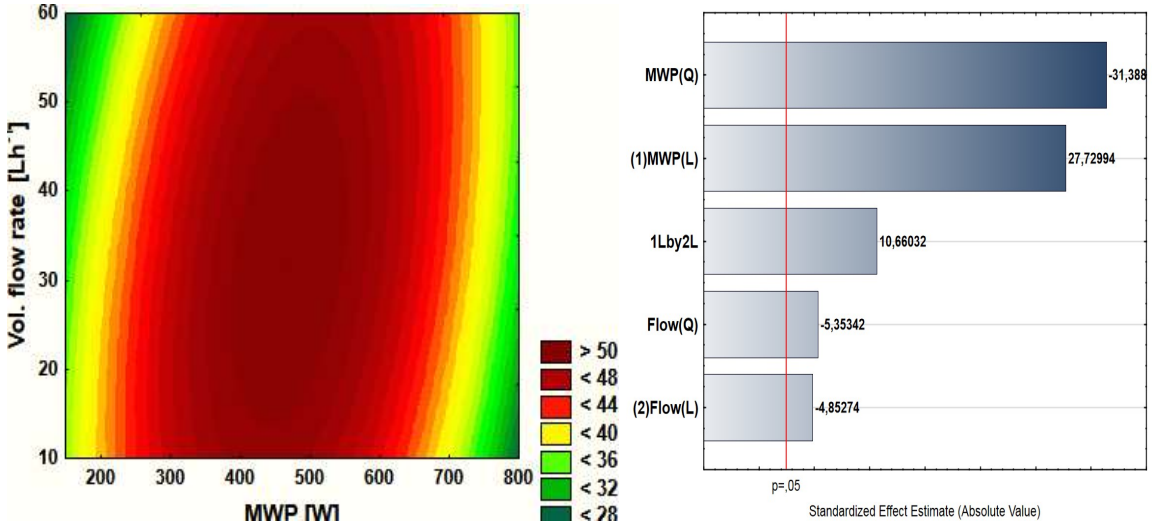
Municipal wastewater samples were originated from a local wastewater treatment plant, purified wastewater was sampled after biological stage of WWTP. Raw (untreated) food industry wastewater sludge sampled from the puffer tank of wastewater line of a dairy factory.

MW pre-treatments were performed in a tailor-made continuously flow microwave reactor; equipped by a continuously irradiating variable power magnetron operating at a frequency of 2450 MHz. Power of magnetron was adjusted by the heating voltage. The flow rate was varied by the speed of peristaltic pump. Dielectric constant (ε') was measured in a tailor made dielectrometer system equipped with a dual channel power meter (Rohde &

Schwarz). ε' was calculated from the phase shift (ϕ) and reflection coefficient (Γ).
Chemical oxygen demand (COD) was measured by colorimetric method (APHA, 2005). Biodegradable fraction of organic matters was quantified by 5 days biochemical oxygen demand (BOD) tests. Aerobic biodegradability was characterized by the ratio of BOD to COD.

RESULTS

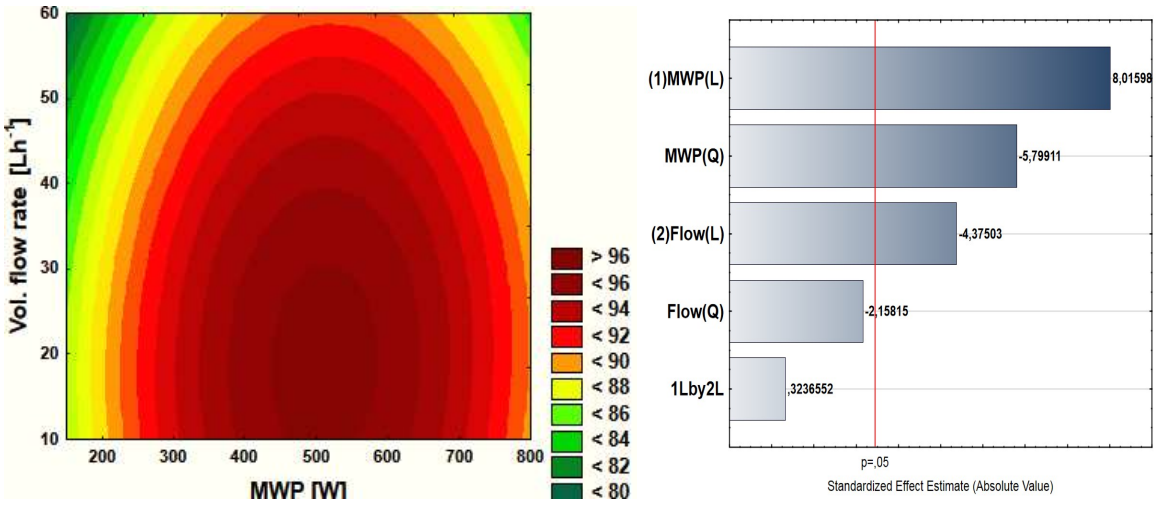
In the first series of experiments, the effect of continuously flow microwave pre-treatment on aerobic biodegradability of dairy processing sludge was investigated. Our results show that microwave power (MWP) and volumetric flow rate has also significant effect on biodegradability (α=5%). Microwave pre-treatment has been verified suitable to increase the biodegradability of dairy sludge. But after a certain value, increasing of MWP resulted in lower biodegradability. Optimum range for MWP and flow rate was determined as 400-500 W , and 20-45 Lh^{-1}, respectively (*Figure 1*).



a) **b)**

Figure 1. Contour plot (a) and Pareto chart (b) for the change of biodegradability of dairy sludge

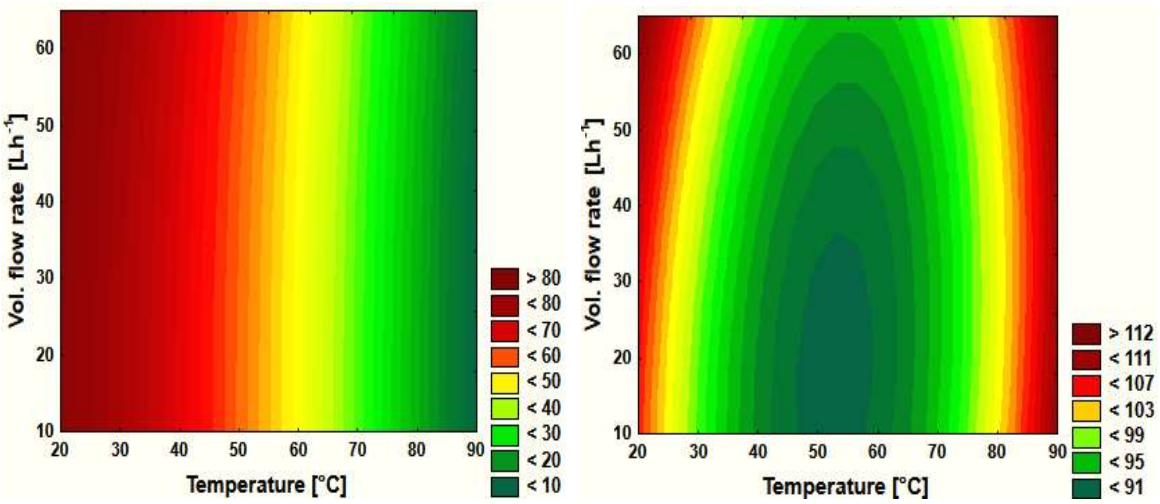
Similar tendency has been arisen for the change dielectric constant as the function of MWP and flow rate, than that of obtained for biodegradability. During the microwave pre-treatment the sludge particles were disintegrated, the solubility of organic matter content increased, furthermore the cell walls are disrupted, these effects led to enhanced biodegradability. The physiochemical changes occurred by microwave irradiation have effect on the polarization ability of different components. Due to the thermal hydrolysis of macromolecules and the release of intracellular polar and ionic compounds to sludge liquor increase the dielectric constant. After a critical thermal stress Maillard reaction and aggregation of hydrolysed organic compounds take place during the energy intensive microwave irradiation what led to decreasing in biodegradability and dielectric constant, as well (*Figure 2*). Considering the results of ANOVA can be established, that flow rate of pre-treatment and microwave power has also significant effect on dielectric constant, but interaction between the two parameters was not significant at confidence level of 95%.



a) b)

Figure 2. Contour plot (a) and Pareto chart (b) for the change of dielectric constant (dielectric constant was measured at 25°C for all samples)

To further investigate the applicability of dielectric measurement for sludge and wastewater treatment purposes, municipal wastewater has been involved into the research work. *Figure 3* show the temperature dependency of dielectric constant for raw (fresh) municipal wastewater (b) and purified wastewater (a) at different flow rate ranges. Purified wastewater samples are originated from purification technology in which mechanical and biological treatment stage was applied.



a) b)

Figure 3. Dielectric constant of purified (a) and raw (b) municipal wastewater as function of temperature and flow rate

The tendency of dielectric behaviour of purified wastewater was similar that of obtained for pure water, i.e. dielectric constant decrease with increasing temperature, furthermore the flow rate has not significant effect on dielectric parameter. In the case of raw wastewater a decreasing tendency of dielectric constant was found in the temperature range of 15-50°C, but temperature increment in the range of 60-90°C led to increasing of dielectric constant. Because the raw wastewater has higher organic matter content (COD: 954 mgL^{-1}) than purified water (COD 110 mgL^{-1}) the temperature increment led to the

disintegration and hydrolysis of particulate organic matters. The difference between the absolute value of dielectric constant of purified and raw wastewater is due to the different composition. At lower temperature range the dipolar rotation mechanism dominate resulted in decreasing tendency of dielectric constant, but over a critical temperature range (50-60°C), where disintegration has been taken and concentration of lower molecular weighted and polar components start to increase, the tendency of change in dielectric constant turn to increase (*Figure 3.b*). At higher temperature range the ionic compounds of intracellular substance have been released, therefore the ionic conduction mechanisms contribute to the increment of dielectric constant, as well. In the case of high organic matter contented raw wastewater the change of flow rate during irradiation has also effect on the instantaneous value of dielectric constant, because the change of velocity affect the disintegration degree of organic particles, and migration ability of ions and movement of dipolar components in oscillating electromagnetic field.

CONCLUSIONS

The main aim of our research work was to examine the applicability of dielectric measurements for determination of structural change of wastewater and sludge. Our results verified that microwave irradiation is suitable to enhance the biodegradability. In continuously flow microwave pre-treatments the flow rate and the microwave power can be considered as influential parameters. Considering the results of dielectric measurements and biodegradation tests relationship can be found between dielectric constant and aerobic biodegradability of sludge. Furthermore, dielectric measurement was suitable to detect the organic matter removal efficiency during the wastewater purification technology.

ACKNOWLEDGEMENTS

The authors are grateful for the financial support provided by the OTKA, project number: K115691. This project was supported by the János Bolyai Research Scholarship of the Hungarian Academy of Sciences.

REFERENCES

BARBA, A., D'AMORE, M. (2012): Relevance of dielectric properties in microwave assisted Process. In Microwave Materials Characterization. Costanzo S. (Ed.), Intech., 170 p.

BRODIE, G., DESTEFANI, R., SCHNEIDER, P.A., AIREY, L., JACOB, M.V. (2014): Dielectric properties of sewage biosolids measurement and modeling. Journal of Microwave Power and Electromegnatic Energy, 48: 147-157.

HOLTZE, C., SIVARAMAKRISHAM, R., ANTIONETTI, M., TSUWI, J., KREMER, F., KRAMER, K.D. (2006): The microwave absorption of emulsions containing aqueous micro and nanodroplets: a means to optimize microwave heating. Journal of Colloid and Interface Science, 302: 651-657.

KAPPE, C.O. (2004): Controlled microwave heating in modern organic synthesis. Angewandte Chemie, 43: 6250-6284.

Review on Agriculture and Rural Development 2017 vol. 6 (1-2) ISSN 2063-4803

YOUNG FARMERS AND SUSTAINABLE DEVELOPMENT

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ABSTRACT
Agriculture, including land cultivation and livestock breeding, still has an important part in preserving the quality of life of the rural population in Hungary. Therefore, it is an important break-out point of the aging domestic agricultural sector to recover the willingness of "young farmers" for agricultural production. The restructuring of the agricultural society by qualifications, age, gender, and the chosen production form is still in progress at present. Thus, it is a national economic interest, and also a task to ensure a steady supply of young farmers. Farming in the spirit of sustainable development is a multi-actor field where learning imposes responsibility not only on the young farmers themselves but also on the groups continuously training them. This value-creating knowledge, work and experience are essential to be handed down from generation to generation. A spectacular growth can be achieved on the farms controlled by professionally well qualified farmers with a sustainable farming approach, thus better contribute to the development of the country. Sustainable management will not remain theoretical knowledge only, but also integrates into everyday life and will be the base of the farming business.

Keywords: young farmers, sustainable development, agricultural sector, agricultural society

INTRODUCTION

The Hungarian Government has adopted the Community Support Framework (CSF) in May 2003 and created the Agricultural and Rural Development Operational Program (ARDOP) in 2004 in relation to this. One element of this action programme was among the first to formulate and recognize the social and economic problems of the young farmers and to declare the concept of “young farmer”. The program makers, similarly to the international trends, observed the increasingly unfavourable age structure and headcount ratio of the labour force engaged in agricultural activity in Hungary. They endeavour to improve it and they realized that it is important for the future of agriculture in terms of well-trained and skilled entrepreneurs to establish an economically viable enterprise, to create jobs and not only sustain the individual and the family. This discovery later became the basis for a number of professional articles on the subject, analysing the case history, the present course and future development of the situation, providing guidance for remedy. In Hungary, agriculture contributes approximately 4% to the GDP, which is slightly higher than the European average. The importance of agricultural sector in the national economy is shown by the fact that in addition to tourism it is only agriculture that has a positive trade balance. In 1999, there were 275 thousand people employed in agriculture, forestry and fishing sector altogether, in 2005 only 194 thousand, while in 2008 it dropped to 174 thousand (HANTOS, 2010).
In our country, 5.3 million hectares of agricultural land are cultivated; less than 5% of the population – 174 thousand people – work in agriculture and their numbers are steadily declining (NAGY, 2015). 90% of the agricultural area is cultivated by approximately 180 thousand farmers (PÓLYA, 2014). The number of the population living from agriculture is currently less than 200 thousand people can be made, this number should be closer to 500

thousand that was 25-30 years ago. If the sustainability of agriculture does not increase, the rural areas of will be declined and we can reckon with continuing impoverishment. (LÁZÁR, 2015) The AGRYA (Hungarian Association of Young Farmers) and CSO (Central Statistical Office) carried out joint research. Their research programs focused primarily on the generation issues of young farmers. In the analysis, it was found that the share of agriculture in the GDP of Hungary was 3-4%, while taking into account the sectors built on agriculture it is 10-12%. Considering the year of 2014 the number of businesses engaged in agricultural activities was 8442 and 485 thousand private farms were registered. 31% of farmers are over 65 years old, and the average age is 56 years. 61 763 young farmers were recorded also in the year of 2014, which is 12.8% of the total number of farmers. The average age of young farmers is 34 years, out of which 77% were male, and 23% female (LACZKA, 2014).

In the long term in Hungarian agriculture the further decline in the agricultural workforce should be avoided. Today, there are two important reasons why the number of employees in agriculture must be stabilized. One reason is that the level of domestic employment rate has to be increased, and in case of the rural population with low skills it can be improved only in this sector of the national economy. The other reason is that although there was an increase in agricultural productivity in recent years, its fundamental cause was the strong decline of the share of the livestock sector (NAGY AND BARÁTH, 2015).

MATERIAL AND METHOD

Today's biggest problem is the gap between the "three legs" of sustainability (natural, social, and economic) keeps growing. Rather than the quantitative growth of economy, the improvement of the harmony among nature, society and economy would be a goal, the way to which would be through qualitative changes. Rural depopulation, and aging would make the functioning of the economy impossible. Therefore, an integration based on cooperation should be created in which all businesses find their own place, role and reinforce each other (LUDA, 2012).

These ideas offer an alternative of the rural way of life that cannot be imposed on the young generation, and without the "young farmers" a successful agricultural and rural development policy is unconceivable. The term "sustainable development" is used to express that the quality of human life should be improved, and all the while the life-supporting ecosystems remain inside the load-bearing ability.

Multifunctional agriculture is one that fulfils all production, ecological, environmental, regional and social functions that society expect. It can be distinguished from a one dimensional agricultural concept that focuses, for example, only on the production of food, while other tasks are not taken into account.

Sustainable agriculture is a kind of agriculture that is permanently able to manage both of these types of functions. On the one hand it can be fulfilled by applying sustainable production methods. For example, by observing the rules of water legislation demands and by way of compliance with animal welfare standards, on the other hand, by the admission to compensate for the higher costs of this production, these farming methods, and by remunerating the environmental, social and regional performance (KOPASZ, 2004).

The young farmers of today's Hungary must meet the criteria of both of sustainable, and multifunctional agriculture, however, if they cannot adapt to the changed economic and social conditions, they can be segregated, their production potential and mood can be reduced and they might become unemployed.

Among the global challenges facing agriculture there is the climate change that determines the trend of development. The rising young agricultural generation must adapt to this. The increasing demand for food (quantity, quality, and safety) challenge young farmers in a way that makes it essential to monitor continuously the technical development of agriculture and the application of the results of innovation, along with environmental sustainability. The goal is to acquire a high level, technically advanced and environmentally sustainable management of young farmers. The precision plant cultivation and genetic engineering are the tools for sustainable field management.

The use of innovative agricultural technology the acquisition of which is essential for young farmers, is a relative advantage, however, it is associated with additional investment needs (TAKÁCS GYÖRGY, 2015).

This is the task of the successfully operating Agricultural Knowledge System (AKS) in Hungary. The Agricultural Knowledge System, that is knowledge creation, knowledge transfer and innovation institutions, and their services are used especially by young farmers. This is due to the fact that the structure and content of the knowledge necessary for the operation of socio-economic subsystems in rural areas has changed, now it goes well beyond agriculture in the strict sense of the word.

The official / formal agricultural knowledge system (AKS) has three main functions: (1) research, (2) education and consultancy (3), which together support the implementation of agricultural policies. The AKS in Hungary, by substantial public support, includes a variety of institutions (ministries, universities, research centres, education and agricultural advisory services). The result of their operation will contribute to the food supply security of young farmers using these services and also to the prosperity of rural development opportunities in Europe (NEMES AND VARGA, 2014.).

RESULTS

The shrinkage of the income generating ability agriculture (particularly in the livestock sector) threaten young farmers with the big dangers. The volume of agricultural commodity production, the volume of sales is vital not because of theoretical, or fiscal possibilities, but because of the lack of alternative livelihoods. Today, the main incentive for economic restructuring is the transformation of the ownership system (SÜLI ZAKAR AND BARANYAI, 1996). The production is based land, which is available only in limited quantities. The "Land to the farmers!" Programme as well as the changed Land Sales Act, which favours the young, local farmers with livestock economy in purchasing land, only slightly relieved the situation. The alleged unjust land rentals and land auctions make the young agricultural entrepreneurs socially fragmented and cause tensions. Production, including food and feed production, becomes more and more the duty of young farmers (native farmers, private entrepreneurs) and/or companies owned or controlled by young farmers. Because of today's ownership restructuring the agricultural population is divided on the question what kind of organizational structure they intend to farm, and whether they want to participate in it full time, as their main occupation or in part time, as a secondary activity.

Because of the declining tendency of the agricultural use of resources it is necessary to explore and analyse other, non-agricultural ways of use. Rural development pays special attention to the needs of non-farming rural population and to meet the needs young farmers who are not agricultural producers and meanwhile, "they focus on the possibilities of the non-agricultural utilisation of the agricultural resources." There is high potential in the processing and the local sales of local products, since bypassing intermediaries the young

farmers could increase their income. It also will have a significant role in the development of the social sector because, in addition to creating new jobs, it is also designed to ensure the appropriate level of care for the rural population. The revival of old handicraft traditions can have dual purpose, one is to provide employment opportunities, and on the other hand, it helps the preservation of local cultural values. The touristic offer supplied with other resources of the particular region (folk music, folk dance) can be built on these values. The potential of tourism options (natural and human resources) could be an important alternative source of income for young farmers. However, it should be noted that of course this form does not provide an equal chance for each settlement and region, but where there is potential for tourism marketing should take advantage of it. However, the development of tourism cannot be a spontaneous process, it will definitely need conscious government, regional and local support (HEKLÉDINÉ HERBÁLY, 2002).
Several forms of tourism are linked to farming (horse riding, hunting, fishing, rural and farm tourism, etc.), and thus they mean important complementary activities for the area and the young farmers working there.

- tourism could create local markets for agricultural products, better prices for exports are available by savings in packing, shipping and customs duties, or - by achieving a higher processing level – in the case of catering consumption;
- in addition to profitability, it could expand employment, create new jobs and increase the skill level young farmers with preparation for these;
- it could help preserve and revive the traditions (embroidery, pottery and other folk crafts, folk songs, dances, folk customs, etc.), at the same time contributes to making rural life more comfortable and more modern by increasing the earnings and the dissemination and services;
- it could contribute to the development of infrastructure and services, as well as speed up the urbanization process.

CONCLUSIONS

The unfavourable market environment, the low profitability and high levels of expectation, bureaucratic law and penal sanctions, and the limited agribusiness segments discourage the would-be young farmers and greatly affect their development prospects. In contrast, the unique pre-financing forms (+ 10%) and the broad financial possibilities, the production of high labour-intensive products, the possibility of family traditions tracking, and the security offered by advocacy associations encourage and promote young farmers to produce! Despite the difficulties, it is a break point to update the ageing Hungarian agrarian society that individual businesses managed by young farmers can achieve spectacular growth with the help of EU and national funds, and thus they better contribute to their own and the country's improvement and also to sustainable development. I believe that an important breakthrough point of the aging Hungarian agricultural sector could be the recovery of young farmers' willingness to produce. To do this, environmental factors of production traditions and the right incentive system in that area is needed. As I see it, the base of the system are the benefits to be provided for young farmers, gaining back the prestige of the profession and the recovery of beneficial agricultural support measures is also necessary. In addition to of the love of farming, and cherishing traditions of land cultivation and animal husbandry, the businesses founded by young farmers must serve national economic interests, such as increasing agricultural gross domestic product (GDP),

or at least maintain the current level to be capable of self-sufficiency and keep up the family.

REFERENCES

HANTOS, K. (2010.): Hatékony generációváltás elősegítése a mezőgazdaságban - A fiatal gazdák támogatása. Budapesti Corvinus Egyetem Tájépítészeti és Tájökológiai Doktori Iskola (PhD) értekezés pp. 31.

HEKLÉDINÉ HERBÁLY, K. (2002): A mezőgazdasági erőforrások többirányú hasznosítása a vidékfejlesztésben. Budapesti Közgazdaságtudományi és Államigazgatási Egyetem Agrárközgazdasági Tanszék PhD értekezés pp. 52.

KOPASZ, M. (2004.): A fenntartható magyar mezőgazdaság Budapesti Corvinus Egyetem Agrár-közgazdasági Ph.D. Program, Budapest pp.29.

LACZKA, É. (2014.): KSH elnökhelyettes előadás AGRYA és Második Hullám Vidéki Ifjúsági Szövetség közös konferenciáján, Budapest 2014.

LÁZÁR, J. (2015.): Miniszterelnökséget vezető Miniszter Makói Nemzetközi Hagyma és Gasztronómiai Fesztivál Mezőgazdasági fórumbeszéd, Makó 2015.

LUDA, SZ. (2012.): Értékelvű agrárvállalkozók szerepe a vidékfejlesztésben. In: Fenntartható fejlődés, élhető régió, élhető települési táj 2. Budapesti Corvinus Egyetem, Budapest, pp. 54.

NAGY, ZS., BARÁTH, L. (2015.): A többtényezős termelékenység és a környezeti állapot változása a magyar mezőgazdaságban, az EU-csatlakozást követően. Statisztikai szemle 93. évfolyam 1. szám.

NAGY, ZS. (2015): A Fiatal gazda támogatások szerepe a mezőgazdaságban. Debreceni Egyetem Gazdaságtudományi Kar 2015. pp. 8.

NEMES, G., VARGA, Á. (2014): Régi intézmények, új kihívások – a Mezőgazdasági Tudásrendszer (MTR) Magyarországon. Az átalakuló, alkalmazkodó mezőgazdaság és vidék. Károly Róbert Főiskola, Gyöngyös, pp. 1140.

PÓLYA, Á. (2014.): Mezőgazdasági termelők gazdaságfejlesztési tervei és annak irányai (AgroStratégia)

SÜLI-ZAKAR, I., BARANYAI, B. (1996): A mezőgazdaság jövője, avagy a fenntartható fejlődés esélyei az Alföldön. Tér és Társadalom, 10. 4. pp.131.

TAKÁCS GYÖRGY, K. (2015): Mezőgazdasági innováció és a fenntartható fejlődés. Károly Róbert Főiskola; LVII. Georgikon Napok Keszthely pp. 395-396.

Review on Agriculture and Rural Development 2017 vol. 6 (1-2) ISSN 2063-4803

DEVELOPMENT POSSIBILITIES OF RURAL TOURISM ACTIVITIES IN THE ALMAJ VALLEY AREA, CARAS-SEVERIN COUNTY

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ABSTRACT
Rural tourism and agrotourism have an extremely important contribution in rural area's development, not only in financial terms but also in terms of increasing and improving the quality of life of residents from these areas. So, the development of these forms of tourism is required in the rural area, both economically and socially. Known as an important ethnographic area of the country, with traditional elements specific, Almaj Valley through natural and cultural potential available, it stands more and more lately by intensifying rural tourist and ecotourist activity. However, tourist infrastructure is very underdeveloped, to rural communities returning the mission to get more involved in this purpose, having in view, the national and international recognition of the high tourism potential of this area
Romanian area still retains, quite well, the traditional, cultural, ethnographic and folklore valences specific to rural areas, providing favorable conditions for development of rural tourism and agrotourism. Romanian villages have a rich tourist potential, having diversified tourist resources: traditions, customs and folk values, cultural monuments, historical and art and an unpolluted natural environment with a rich natural tourism potential.
Almajului Depression known as well as the Almaj Country, Almajului Valley or Bozovici Depression is situated in the South-East side of Banat Mountains, in the south of Caras-Severin county, near the Parallel 45°, being an intramountainous depression, of ellipsoidal form of NE-SW orientation, belonging to Nera basin.

Keywords: agrotourism, agri-tourist boarding houses, rural area

INTRODUCTION

The region is composed of 15 villages organized in compact settlements at the contact between mountainous area and a depression with a population of about 16,000 inhabitants of Romanian origin. From west to east the following major settlements are found: Borlovenii Noi (village known as Breazova), Borlovenii Vechi, Pataş, Prigor, Putna Prilipet, Eftimie Murgu or Rudaria, Bania, Bozovici, Garbovat, Lapuşnicul Mare, Dalboşet, Moceriş and Şopotu Nou. The entire region is polarized from economic point of view by Bozovici village and from tourist point of view by Eftimie Murgu village. There must be mentioned as well Ravenska village belonging to commune of Şopotu Nou which differs by Czech ethnic population, called by locals as "pemi".
In terms of tourism, Almajului Valley is integrated part of tourist area Caraş-Anina, one of the areas with the highest potential in the Banat Mountains, forming a sub-area with unique characteristic: "Almajului Depression - Minis Gorges" which harmoniously blends two types of tourist attractions: those of ethno-folkloric nature from Almajului area and natural and anthropogenic resources of Minis Gorges area giving the whole region a great cultural and landscape value (DOLANGA, 2000).

MATERIAL AND METHOD

In this study we used as research methods induction and deduction and comparative analysis. For the analysis we consulted Statistical Yearbooks of I.N.S and Travel Yearbooks.

RESULTS

One of the essential conditions for the appearance, development and practice of tourism is the existence of a suitable material base consisting of accommodation units, public catering, recreation facilities and treatment for resorts, equipments to provide practicing certain activities with tourism purposes. To all these there are added means of transport and communication ways which have the role to ensure easy access in areas with tourist facilities and objectives. All these form the tourism infrastructure through which the attractive resources of a given territory are exploited in terms of tourism (IANCU, 2014).

In rural tourism areas the accommodation base comprises especially rural boarding houses and agri-tourist boarding houses that often work within peasant households where the tourist, besides accommodation has the opportunity to participate alongside local population at different agricultural activities. Sorted by the number of daisies, rural tourist boarding houses have on one hand the purpose to remove out of isolation some of these activities, to bring financial benefits by providing additional incomes, but as well the one that meets the tourists needs to spend their stay in terms of a disconnected atmosphere and at a more accessible price (RUSU, 2007).

In what concerns the bases of public catering and leisure these are also deficient being resumed only at village shops that can not provide a diversified food and long lasting and at one single restaurant and one cafeteria, both located in Bozovici village and respectively at bars and discos in the village as a means of recreation.

The agritourism offer consists of the whole attractions that may cause visiting certain areas by tourists, as well of network capacity (technical base, infrastructure) to meet, under certain conditions, population's demand (CIOLAC, 2016).

In other words, agritourism offer includes the totality of natural resources (landscapes, climate, vegetation, fauna) and cultural- historical (historical monuments, architecture, museums, memorial houses, elements of ethnography, folklore, folk art, etc.) together with the material basis able to exploit them through agritourism programs.

The tourism resources include the whole of tourism attractions, natural and anthropogenic from an area, region or country. These are generating different forms of tourism being considered constitutive factors of the tourism product (POPESCU, 2016).

The material base of rural tourism consists of the totality of peasant households equipped to receive tourists, attested in this direction and connected to certain form of organization.

The peasant household represents the cell of human settlement of village type. Functionally, it consists of an agro-economic micro platform consisting of the house itself, the auxiliary spaces (summer kitchen, warehouses, etc.) and of household annexes (stables, hay barn, cages) (IANCU, 2014).

The structure of accommodation establishments by category, in the county of Caras-Severin, in the year 2015 is showed as follows, Figure 1.

Agri-tourist boarding houses represent the main accommodation unit in the county of Caras-Severin, with a share of 30.74%, followed by tourist boarding houses with 29.44%. The high percentage of these accommodation structures is due to the fact that, Caras-

Severin county has a high tourist potential, and in recent years the tourism activity in this area has experienced a real increase.

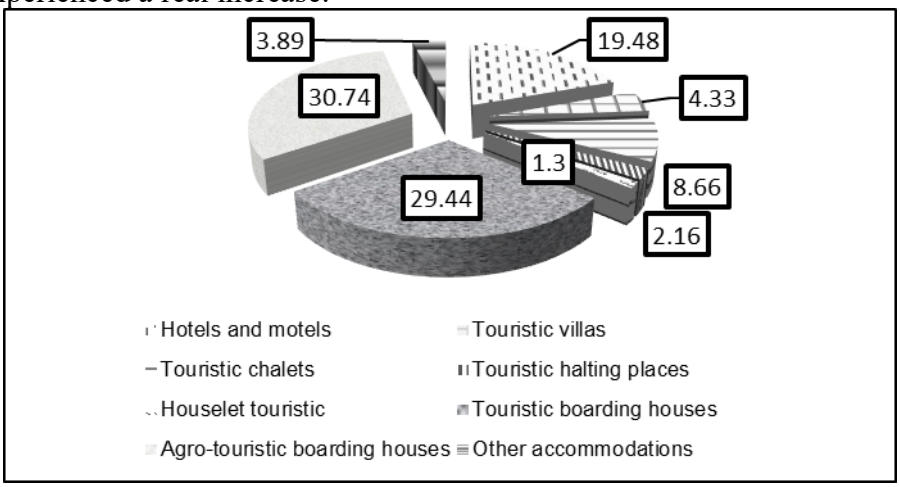

Figure 1. Structure of material and technical base of accommodation by categories of tourist accommodation establishments, Caras-Severin, 2015

Travel enthusiasts in the middle of rural traditions can spend unique moments in the traditional rural landscape from Banat, in an unpolluted environment, where the richness and originality of costume and folklore were kept unaltered.

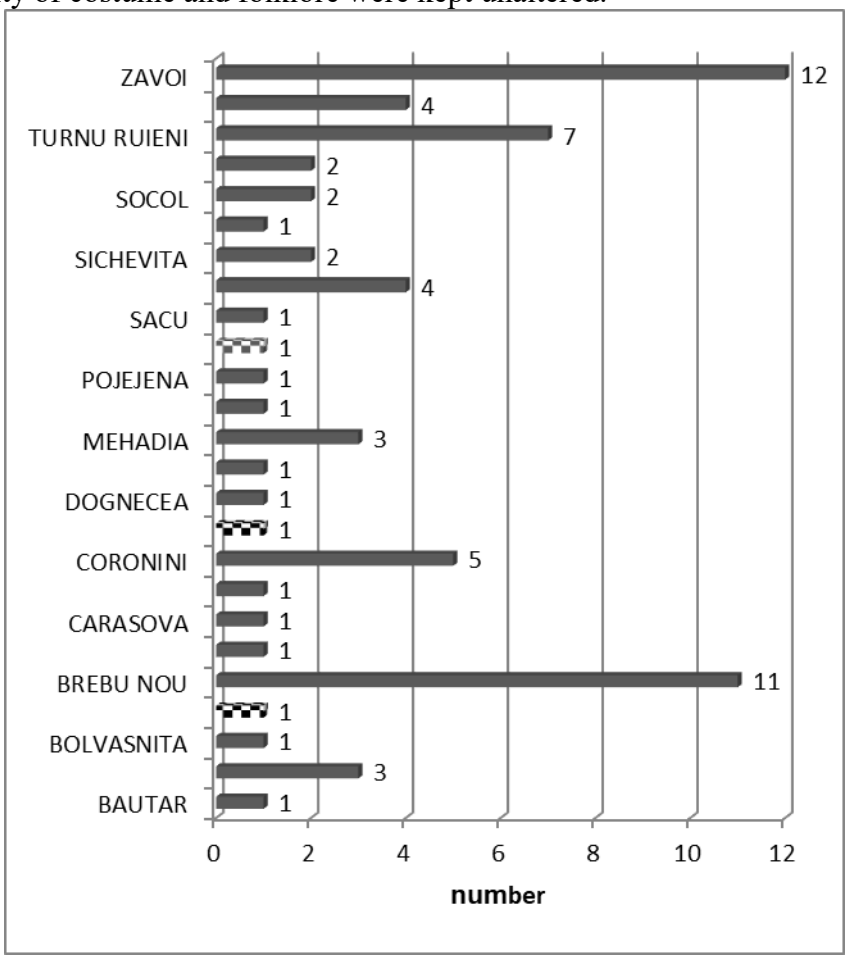

Figure 2. Distribution of agri-tourist boarding houses on the county localities, 2015

From the point of view of areas attractiveness, opportunities to practice agritourism in the county exist in all tourist areas, unfortunately the infrastructure is not sufficiently developed to expand this type of tourism.
In Caras-Severin county, the practiced tourism in rural areas knows a quite intense activity. Currently, though Caras- Severin county has on its whole a significant number of agri-tourist boarding houses - 71 boarding houses in the year 2015, Almajului Valley, has a small number of agritourism units, only three, one for each locality: Bozovici, Dalboşet and Prigor. Despite its extraordinary natural and anthropogenic potential this issue is considered as one of the most important factors hindering the introduction of this region into a tourism circuit well organized to enable the best exploitation of all its resources, namely the almost complete lack of approved accommodation units (WWW.INSSE.RO, 2016).

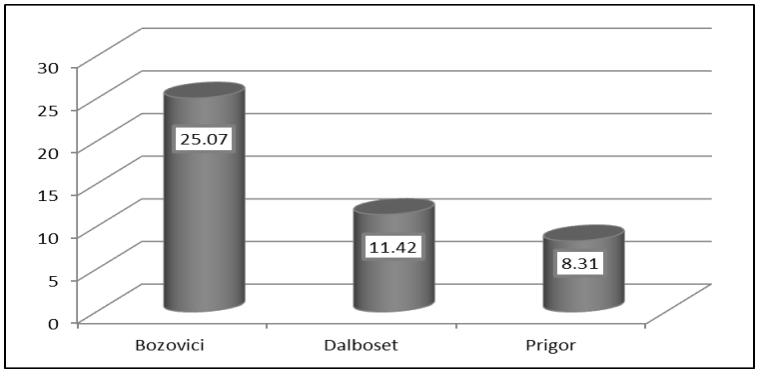

Figure 3. The capacity utilization index of tourist accommodation in service, agri-tourist boarding houses, Almajului Valley, 2015

As regards the capacity utilization degree in operation, in the case of agri-tourist boarding houses from Almajului Valley there can be noticed, that the highest value is recorded in Bozovici locality, 25.07%, exceeding even the county average for this type of accommodation structures - 22.6% and the lowest value of this indicator is recorded in the Prigor locality - 8.31% (WWW.INSSE.RO, 2016).
The tourists accommodated in the existing agri-tourist boarding houses, in the year 2015, at county level accounted for 11.88% of total tourists, 91.88% being Romanian tourists and 8.12% foreign tourists. Between the period 2000-2015 the number of tourists arriving in agri-tourist boarding houses increased by 54.67 times.

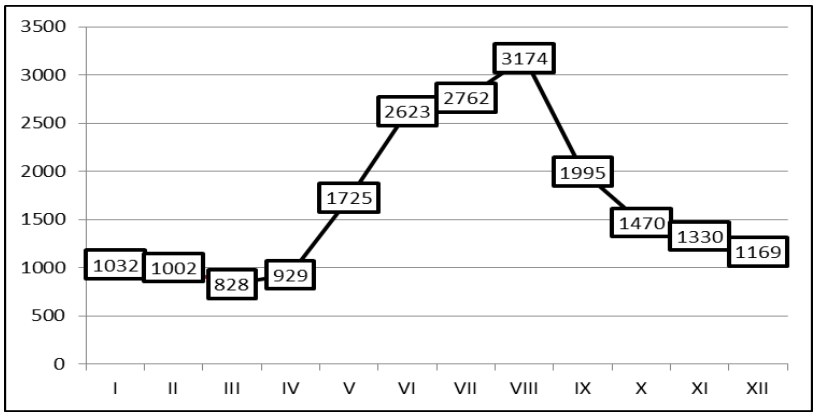

Figure 4. The structure of tourist arrivals in agri-tourist boarding houses by months, Caras-Severin county, 2015

The number of tourists arriving in agri-tourist boarding houses has increased during the period 2005-2015 by 15.58 times. The number of tourists accommodated in existing tourist boarding houses at the level of Almaj Valley area is very low, only 3.84%, compared to the potential of the region and to tourist arrivals frequency in the area. This is due to the fact that within the studied area the accommodation infrastructure is underdeveloped.
As regards the distribution of tourist arrivals in agri-tourist boarding houses in Caras-Severin county there can be seen a concentration of these in summer months from June to August. The maximum value, 3174 tourists was recorded in month of August, and the minimum one in month of March - 828 tourists (WWW.INSSE.RO, 2016).

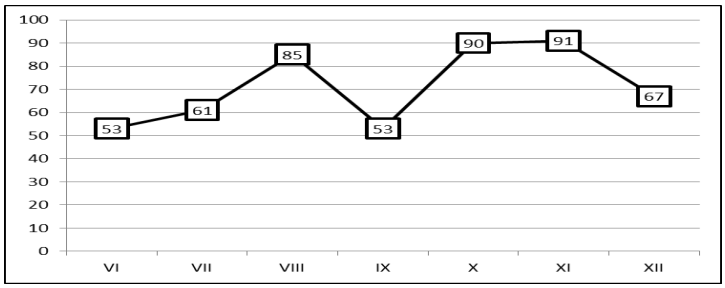

Figure 5. The structure of tourist arrivals in agri-tourist boarding houses by months, Bozovici locality, 2015

The analysis of tourist arrivals in agri-tourist boarding houses from Bozovici locality indicates that these are concentrated in the second half of the year, between the months of June and December. It was also observed that in August and October-November there are recorded the highest values of this indicator.
The lack of adequate and approved accommodation units included in the database of specialized bodies adds as well the issue of the impossibility of precise determination of tourist flows, thus making impossible to establish an accurate estimation of tourist traffic. For Almajului Valley unfortunately, there is no data regarding tourist flows, number, frequency and their origin can not be determined with precision, nor their favorite season for practicing tourism, there can only assume that it is more intense in summer season when weather conditions allow the installation of tents in areas like Rudariei Gorges. Precisely for this reason the practiced tourism in this area is often ranged in itinerant tourism classification and of the weekend one.

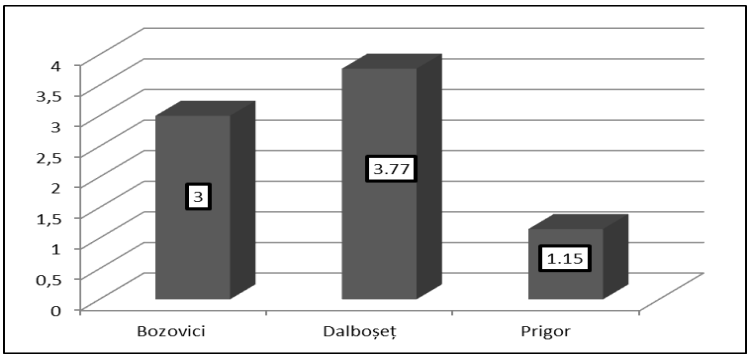

Figure 6. Average length of stay in agri-tourist boarding houses, Almajului Valley, 2015

In the year of 2015, the average length of stay has recorded in the Almajului Valley a value of 2.64 days/ tourist, classifying below the county average value, in agri-tourist boarding houses, 3.16 days/ tourist. The highest value of this indicator was recorded in the

locality Dalboşet, exceeding the county average, 3.77 days/ tourist and the lowest value in the locality Prigor, of only 1.15 days/ tourists (WWW.INSSE.RO,2016).
Following the analysis performed, it is necessary that agritourism in Caras- Severin county and especially within Almaj Valley to quickly assess its chances of launching and to become one of the key branches of the county economy. Through this it would achieve a number of remarkable positive effects, notably: the creation of new jobs, the geographically transfer in terms of resources, layout and land use, equilibrating the balance of payments, a faster integration through Romania tourism within European Union. There must also taking in consideration the fact that agritourism has a greater impact than other activity at the development of other industries too. It is necessary to perform a brief analysis to determine the main priorities for the development of rural tourism and agritourism in our county, especially since it faces profound changes in recent years imposed by the transition process to market economy.

CONCLUSIONS

A strength of the region is represented by the anthropogenic heritage of ethno-folkloric nature, very rich and preserved in large part as well due to isolated position of villages in the Almajului depression. This heritage consists of a series of buildings such churches, monasteries, houses built in traditional style, but its uniqueness lies primarily in immaterial dowry consisting of customs and traditions specific to Romanian village, as well as of historical past who put the footprint especially over the spiritual dowry by all personalities who have given.
By analyzing all these aspects of tourism at Almajului Valley level, along with the proposals and developing opportunities at local level, county and regional level, there is observed primarily the low level of tourism activity supporting initiatives and concrete measures taken in this regard. Therefore it requires as fundamental measure the need to consider tourism as an activity that can contribute to both economic revitalization of the area by the additional revenues that it generates, as well to preserve the traditional specific of the area by tourist valorification of ethno-folkloric elements of popular costumes, customs manifestations of popular character specific activities and crafts.
These initiatives must start locally by involving public authorities in taking measures and designing financing projects, attracting investors and funds aimed at supporting and implementing these projects and informing local people of the benefits that rural tourism can bring. It is necessary also the ongoing collaboration across the three levels: local, county, regional, given the importance it has today the overall development strategy at the level of regions and areas.

REFERENCES

CIOLAC, R., CONSTANTINESCU, S., STRĂIN, L., RUJESCU, C., BĂLAN, I. (2016): Investments in agrotourist establisments from mountain area and forecasts related to their recovery, SGEM Conference on Political Sciences, Law, Finance, Economics Tourism, Conference Procedings, vol IV
DOLANGA, N. (2000): Tara Almajului, București
IANCU, T. (2014): Economie agroturistică, Editura Eurostampa, Timișoara

POPESCU, G., ADAMOV, T., DINCU, A.M., IOSIM, I. (2016): Positive and negative trends of the Romanian tourism, SGEM Conference on Political Sciences, Law, Finance, Economics Tourism, Conference Procedings, Book 2, vol V
RUSU, S. (2007): Turism rural și agroturism, Editura Mirton, Timișoara
INSTITUTUL NAȚIONAL DE STATISTICĂ (2016): www.insse.ro

Review on Agriculture and Rural Development 2017 vol. 6 (1-2) ISSN 2063-4803

BUYING LOCAL? WHO, WHAT, WHY?

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ABSTRACT
The National Rural Development Programme for the period 2014-2020 through its priorities and interest domains refers to local products and short supply chains in order to increase the competitiveness of local primary producers and the added value of agro-alimentary and non-alimentary products, and to promote on local markets through short supply chains, producers groups and organizations. Local food can have many benefits for the actors involved in the short supply chain, more precisely producers, middlemen and consumers, but also for the local economy in its all.
The local market from Timisoara is provided by many local producers from rural area that are producing and selling a varied number of alimentary and non-alimentary products. The case study is oriented towards the brief analysis of alimentary local products' consumers and its aim is to realise a profile of local food consumer through underlining the aspects regarding the reasons why they are buying such products, the place from where they buy, but also aspects regarding the implications and benefits the consume can have.

Keywords: local food, short supply chains, consumer, benefits

INTRODUCTION

The term local food is widely used but there are no precise standards to define this term. In many cases, the consumers define local food as food grown within a county or coming from neighbouring areas (HARRIS, 2000).
Today many people are concerned about their food, about the place where it is produced and technologies used to obtain the food products. But there are also others food characteristics like freshness, quality, environment impact that are in people's concern.
The interest for local food is growing and consumers decide to buy local due to a variety of reasons, but mainly due to perceived nutritional superiority, health benefits, advantages for local economy and also helping protecting the environment (DUMITRESCU, 2005, ZEPEDA, 2006).
Local food quality is the result of the combination of many quality characteristics, some of which are place- related (ARFINI ET AL., 2012).

MATERIAL AND METHOD

The case study is based on questionnaires applied in two markets from Timișoara. The markets were choose due to the fact that here the local producers from around the city come and sell their products every day, not only in some days as it is the case of the mobile market.
We applied 100 questionnaires, 50 for each market in the period February – March 2017. In choosing the persons to apply the questionnaires we use the random sample and the respondents were not rewarded. The questionnaire had 12 questions, from which 7

questions have fixed answers and the respondents have to mark the answer suitable for them and 5 questions are with open answer.

RESULTS

The buyers of local food were asked at the beginning of the interview if they are also consumers and 100% said they are consumers of local food. So, they were asked to offer the answers to the questions only thinking at their only individual not at their household.
Asking the buyers to define the local food, the majority (76%) of them defined local food as food which is produced in the area they live, but no references were given to the area delimitations. A part of them (7%) associate local food with food produced in Romania and the percentage of 4 buyers considered local food only if the village where it was produced was marked on the label, for example cabbage from Belint, watermelon from Gottlob etc. a number of 5 consumers said there must be a definition for local food in the legislation but they don't know it and 8% of buyers sais local food means food produced in the areas very closed to the city.
From the persons who answered to the questions, 73% were women, while only 27% were men. Referring to the age, there were five age classes: 15-24 years, 25-34, 35-44, 45-60, over 60 years old. The persons younger than 15 years old were not taken into consideration due of fact that they were accompanying older persons to the market, usually their parents or close relatives. The number of respondents for each class can be observed in *Figure 1*.

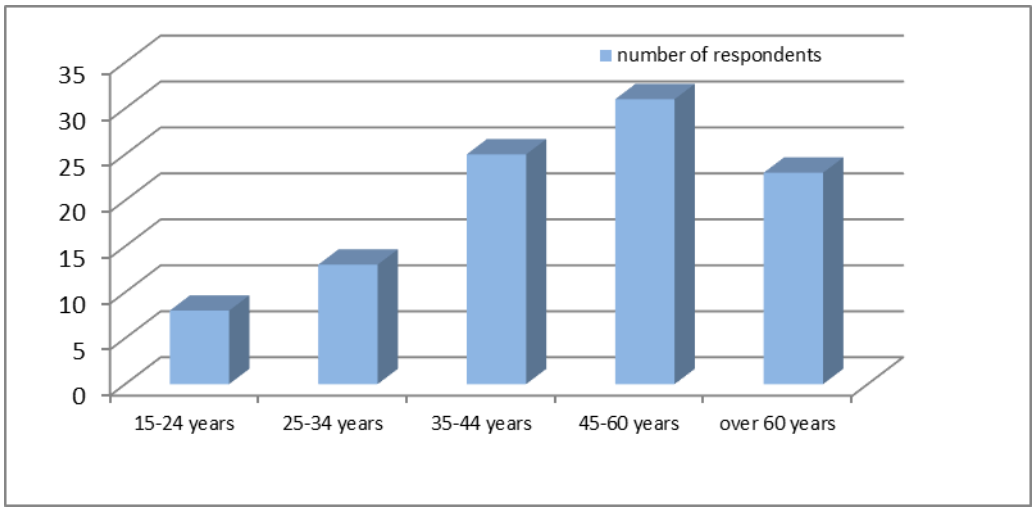

Figure 1. Respondents age classes

While asking if all the food products are local, the largest number of consumers buys only a part of the food products as local because of the seasonality and limited range of products as shown in *Figure 2*.

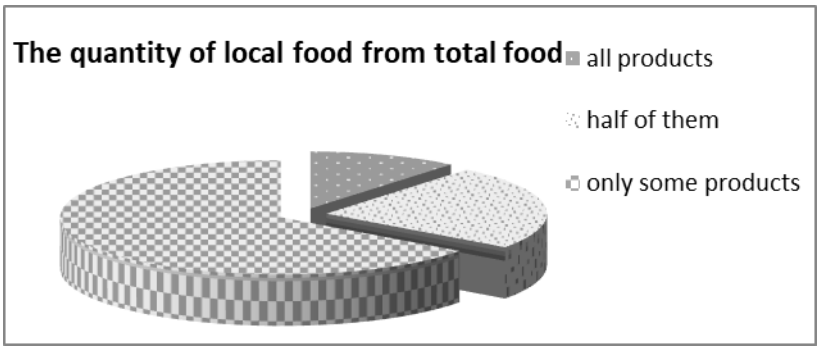

Figure 2. The quantity of local food from total food bought

As it can be seen in *Figure 3*, the reasons for which the consumers are buying local products are different. There were 5 predefined answers and one where the consumers were asked to specify their reasons at this item. There was no specified number of marks related to the reasons for buying local food.

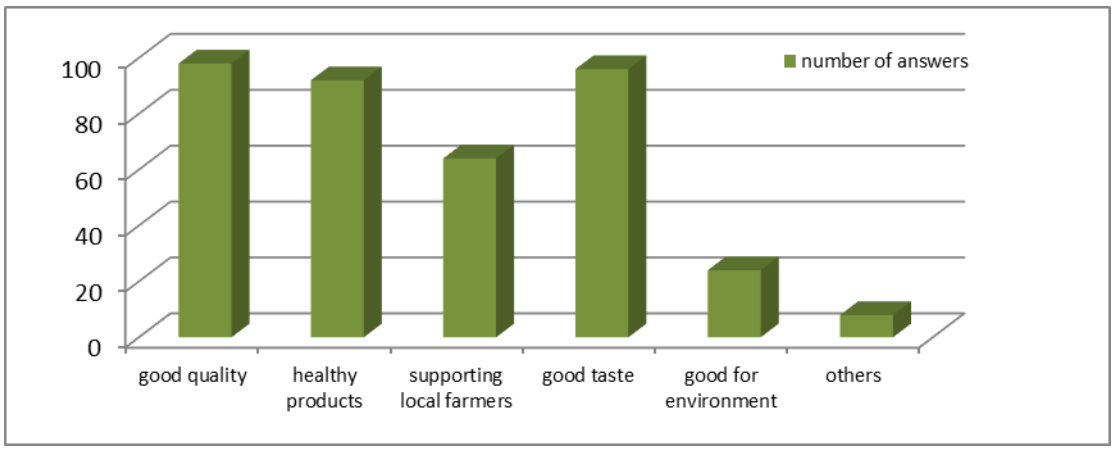

Figure 3. Reasons to buy local food

The questionnaires were applied in the markets, but there was also some interest in seeing all the places the consumers buy local food so there were predefined 6 product class or type, more precisely fruits, vegetables, meat, dairy and eggs, bakery products and others (*Figure 4*).

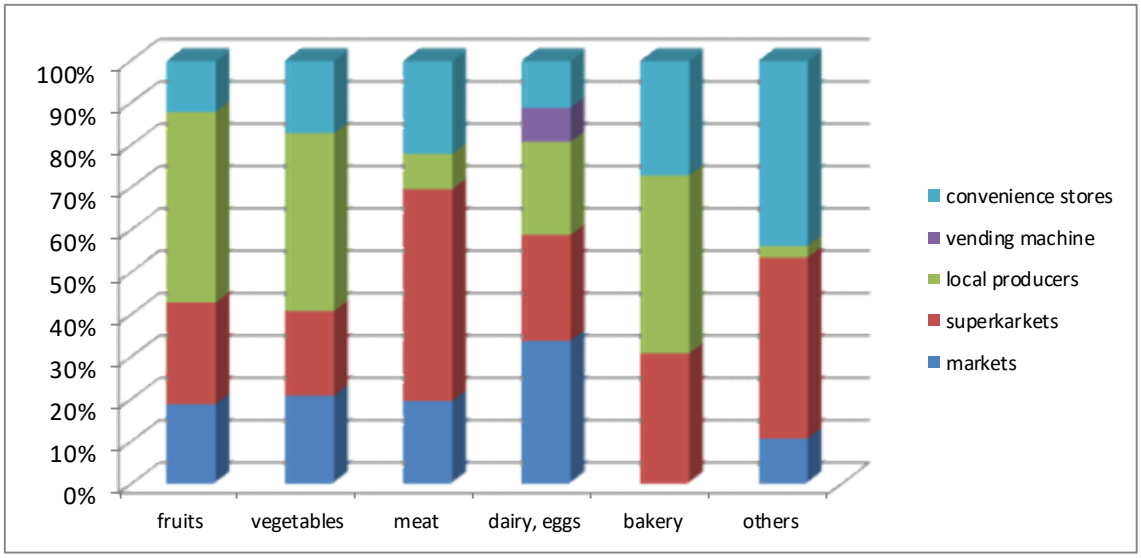

Figure 4. Places the consumers buy local food

For fruits the answers were divided between supermarkets for the fruits that are not cultivated in our area, local producers that are selling also on the internet and making delivery just to the customers' address, markets. For the vegetables the answers were very close to the ones referring to fruits. Here it must be mentioned according to consumers' answers they are buying from supermarkets because they don't find all the seasons the products they need and also some of them considered that buying from supermarket give them a security feeling cause there is known the producer or even the country the products are coming from. In addition, there must be underlined that the supermarkets active in Timisoara are also occasionally selling local food that comes from local producers and this kind of products is distinctively marked on shelves. The majority of consumers said they buy the meat and meat products from supermarkets due to the variety offered and to the food security control made in supermarkets, while for dairy and eggs the consumers opt also for the vending machines from the city. The bakery products were bought from local bakeries, some of them with tradition on local market, while others products were bought from different stores.

Referring to the benefits local food can have for the local area and community, the respondents opinion were that local food are good for the health and they are high quality products that represents the area. Also, the local food can bring benefits to local community due to the fact that people around the city are involved in their production and selling and also they are good for the environment.

The main reasons for which the consumers don't buy more are the seasonality of the production and sometimes the price, usually when the producers are coming to the market for the first time with early vegetables. Also, here can be found the markets disposal in the city and the fact that if they are going to the supermarkets for shopping they don't go also in the local markets.

But the buyers would be encouraged to buy more local food if there were special spaces arranged for local producers where to have access only registered producers, more mobile markets and if in the supermarkets would find more often local products.

CONCLUSIONS

Starting from the varied opinions regarding the definition of local food is hard to establish an exact profile for local food consumer.

The local food consumer from Timisoara only buys a part of the food as local products mainly due to the availability of the products. The persons over 35 years old are more concerned on the food they buy and so they try to orient towards local food which they associate with quality and healthy products. The consumers buy local food for their quality, for the taste, also because they consider local food as being healthy food and for supporting the local economy and the environment.

ACKNOWLEDGEMENTS

This work was published during the project "Internal competition of research projects of Banat's University of Agricultural Sciences and Veterinary Medicine "King Michael I of Romania" from Timişoara, 2015 session, contract no. 2759 - Innovative approach of local food mapping in the context of competitive development of short food supply chains.

REFERENCES

ARFINI, F., MANCINI, M.C., DONATI, M. (2012): Local Agri-food Systems in a Global World: Market, Social and Environmental Challenges, Cambridge Scholars Publishing, pp.76.

DUMITRESCU, C.S., BUNEA, D.M., ANDRAS, M.D., MARTIN S.C., MARCU, V. (2015): Local products' capitalisation as a contribution to local development, Journal of Biotechnology, no. 208, pp S49-50

HARRIS, B., BURRESS D., MERCER S., OSLUND P., ROSE C. (2000): Kaw Valley Focus Groups on Local and Organic Produce, University of Kansas, IPPBR Report No. 254B

RURAL DEVELOPMENT NATIONAL PROGRAMME 2014-2020, Romania

ZEPEDA, L., JINGHAN, L. (2006): Who buys local food?, Journal of Food Distributon Research, no. 37(3), pp 5-15

Review on Agriculture and Rural Development 2017 vol. 6 (1-2) ISSN 2063-4803

PERCEPTION OF ROMANIAN BANKING SYSTEM BY THE BENEFICIARIES OF RURAL DEVELOPMENT PROJECTS

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ABSTRACT
Romania, being a Member State of the European Union since 2007, receives important amounts from the European Agricultural Fund for Rural Development of the EU for funding economic activities in the rural area. As the payments for the Community projects are settlement payments (i.e. the payments are settled in installments after being made, the entrepreneurs need forward funding for their investments, and, therefore, the banks play an important role in forwarding the funds for the projects, as well as in co-funding the eligible expenses.
This paper analyzes the way in which the beneficiaries of rural development projects perceive the assistance given by the Romanian banking institutions regarding the steps they must make in order to obtain a loan or to benefit of other necessary banking products or services for the implementation of their projects.
The research was carried out in Timiș County, between May and September 2016, on a sample of 96 interviewees, beneficiaries of rural development projects by the National Rural Development Programme 2007-2013. The data collection methods consisted of the survey made on the basis of a standardized questionnaire, using the "face-to-face" technique and the data collection interview method using the "face-to-face" interview.

Keywords: rural development projects, banking system, sample, survey.

INTRODUCTION

The sustainable development of rural areas is an important priority of the Community policy (CUNDER, 2007, BRADY ET AL., 2009, PELUCHA ET AL., 2017). The financial instruments of the European Union give the opportunity to capitalize on important financial resources for the economic, social and cultural development of rural area (FEHER ET AL., 2016, ZIMMERMANN AND BRITZ, 2016).
A special importance in the investment process in agricultural undertakings and in the rural area is given to the financial support granted from the European Agricultural Fund for Rural Development through the National Rural Development Programme (RAICOV ET AL., 2016). In accordance with version XVI of the NRDP, Romania benefited of EUR 9290.5 million of public funds for the development of the rural area during the financial year 2007-2013, of which EUR 8097.2 million from the Community budget and EUR 1199.3 million from the national budget (MARD, 2015). For the period of time between 2014 and 2020, Romania provided a Community budget appropriation of EUR 8015 million for finding the rural development projects (MARD, 2016) .
The expiry of the implementation period for the projects funded from European funds for the period of time between 2007 and 2013, including the two-year extension period, allows us to perform a correct analysis of the level of fund absorption of the National Rural Development Programme. For the NRDP 2007-2013, 2689 were submitted in Timiș County, of which 1507 projects were selected (eligible projects) and 1381 projects were contracted until 8 June 2016, in accordance with the data provided by the Rural Investment Financing Office of Timiș County. As regards the absorption level reflecting the actual

fund consumption, this is higher in Timiș County for the majority of measures, as compared to the regional and national average. Thus, an absorption level of 100% is recorded in Timiș County for the measures: 322 "Village renewal and development", 312 "Support for the establishment and development of micro-enterprises" and 125 "Improvement and development of agricultural and forestry infrastructure". The fact that for these very important measures aiming to develop the rural infrastructure, the entrepreneurship and agricultural and forestry infrastructure, the county succeeded to successfully complete all projects and consume all contracted amounts is very good, as the payment for these projects had a total share of 38% of the total value of the payments made at the county level for rural development projects.

The aim of this paper is to assess the way in which the participants in the rural development projects perceive the relationship with the banking institutions operating in Romania. The issue was to identify the institutions that gave direct assistance for this purpose, the opinion on the service package cost, the general appreciation level, as well as the general opinion on the usefulness and effectiveness of the rural development projects.

MATERIAL AND METHOD

The research are of this paper was located at the level of Timiș County. The sample comprised 96 interviewees who benefited of rural development projects through the National Rural Development Programme 2007-2013. The field research was conducted between May and September 2016.

The data collection methods consisted of the survey made on the basis of a standardized questionnaire, using the "face-to-face" technique and the data collection interview method using the "face-to-face" interview. I have applied these methods among the beneficiaries of rural development projects in order to see their perception of the Romanian banking system and the way in which the banks support the co-funding process of European projects. The interview method is also a very good method in order to see the challenges the beneficiaries face during the process of project implementations.

This paper is part of a larger research within the Research Project for stimulating the establishment of young and independent research teams, named "Competitiveness, innovation and rural space development subject to European funds. Case Study in Timiș County, Romania".

RESULTS

Most often than not, the persons involved in projects or those aspiring to become involved in such activities cannot support financially the costs that they must bear. Thus, the financial support the banks can give is a frequently used instrument for supporting the activities.

The first question addressed to the persons who carry out funded rural development projects (96 interviewees), **the first question "For which measure did you submit a project?",** analyzes from structural point of view the division per type of approached projects. Thus, ordering in decreasing order depending on the number of answers, we have:

1. Measure 112 "Setting-up of young farmers", 34 projects (35.4%)
2. Measure 312 "Support for the establishment and development of micro-enterprises", 18 projects (18.7%)
3. Measure 121 "Modernization of agricultural undertakings", 16 projects (16.6%)

4. Measure 322 “Village renewal and development”, 13 projects (13.5%)
5. Measure 141 “Support of semi-subsistence agricultural farms”, 9 projects (9.3%)
6. Measure 313 “Encouragement of tourism activities”, 4 projects (4.1%)
7. Measure 125 “Improvement and development of agricultural and forestry infrastructure”, 1 project (1%)
8. Others, 1 project (1%)
9. Measure 123 “Adding value to agricultural products” , 0 projects (0%)

We see an increasing interest in those projects that support primary initiatives or entrepreneur debut, with over 54% of projects massed under the first two hierarchically ordered measures, i.e Measure 112 and Measure 312. The attraction for tourist activities is no longer a focal point under the area analyzed. Only seldom do we find infrastructure enhancement and development projects or projects related to the increase in added value for agricultural projects among options of respondents. Explanations may be multiple, however, they clearly indicate a level of agricultural systems (and accessory sections) still a long way off maturity, with debut projects still being preferred to development projects.
For **question number 2 ”What are the organizations having granted you support in accessing EU funds for agriculture and rural development?”,** after counting the answers given, we obtain the following list:

1. The Rural Investment Financing Agency RIFA (former Agency for Rural Development and Fishing ARDF), 53 answers (55.2%)
2. Advisory Companies, 27 answers (28.1%)
3. Agricultural Directorate for Rural Development, 8 answers (8.3%)
4. National Agricultural Advisory Agency/ County Agricultural Advisory Office, 4 answers (4.1%)
5. Professional Associations, 4 answers (4.1%).

RIFA/ARDF was encountered in more than half of people’s answers and thus leads in a chart of organizations having granted support in the matter. Also, advisory companies played an important part in supporting the accession of projects to be funded.
Question number 3 ”Have you ever resorted to a bank for the financial support of activities financed under the 2007-2013 NRDP?” generated the following answers: 62.5%, i.e. 60 people have called upon the services of a bank, compared to 37.5%, i.e. 36 people that have not resorted to banks.
The following set of questions, i.e. questions 4, 5, 6 and 7, was only addressed to such respondents having called upon a banking organization in view of financially supporting the activities provided under the project, i.e. 60 people.
Question number 4 indicates preferences for one bank or the other: **“Which bank offered you the best deal for financially supporting your project?”.**

1. Banca Transilvania, 18 answers
2. BRD, 11 answers
3. BCR, 10 answers
4. Raiffeisen Bank, 8 answers
5. CEC Bank, 5 answers
6. UniCredit Țiriac Bank, 3 answers
7. Other, 5 answers

Banking financing mechanisms are quite diverse, at this time, thus offering entrepreneurs the possibility to select the right option from a wide range of services offered. Therefore,

question number 5 "What banking products and services have you benefited from?", may indicate a potential chart of the usefulness for certain services offered.

1. Supporting loan for the pre-financing of investments provided under the project, 27 answers
2. Letter of bank guarantee, 13 answers
3. Special account for receipt of non-returnable financing received within the project, 12 answers
4. Investment loan for co-financing of the own contribution factor to the project, 4 answers
5. Loan for co-financing of non-eligible expenses, 2 answers
6. Comfort letter, 2 answers
7. Other, 0 answers.

User satisfaction concerning the aid offered by banking organizations was assed under **question number 6 "To what extent are you satisfied with the aid offered by banking organizations in supporting non-returnable financing projects? (1-completely dissatisfied, 5–very satisfied)"**. The 60 people having resorted to banking institutions have supplied, on a scale of 1 to 5, the following answers:

1. 48.3% (29 persons) granted 4 points
2. 33.4% (20 persons) granted 5 points
3. 11.6% (7 persons) granted 2 points
4. 6.7 % (4 persons) granted 4 points
5. None completely dissatisfied

Note that, technically, over 81% of answers range in the upper segment of satisfaction (4 and 5 points), quite the opposite to the answers provided for **question number 7** "**How do you feel about the costs of service and product packages offered by banking organizations for implementation of European projects?**", which noted that no respondent has perceived costs as being "low". More than half (34 persons) deemed such costs "acceptable", while 26 persons stated that costs were "high".

In the latter part of the study, we wanted to find out the views of farmers related to the 2014-2020 programs. An analysis of upcoming options, **"For the 2014-2020 programs, are you interested in submitting and contracting NRDP projects?",** was undertaken by **question number 8.** As such, 87 persons gave a positive answer (YES), while 37 said NO, which clearly indicated an increasing interest for such activities, in the future. For the purpose of interrogating the 87 persons on the type of project they intend to select, we asked **question no. 9 "What kind of support/investment are you interested in submitting proposals for?".** The answers were as follows:

1. Investment for modernizing commercial operations, 30
2. Infrastructure development in the rural environment, 17
3. Investment in non-agricultural activities, 14
4. Support for small family farms, 8
5. Support for groups of manufacturers, 3
6. Processing investment, 4
7. Other, 11.

On this occasion, options seem to drive towards a more mature stage: there is an increase in the tendency to approach modernization and development projects. Moreover, confidence in NRDP is high. For **question 10 "What impact do you believe the NRDP to have on economic growth in Romania? (1-extremely low, 5-extremely high)"**, 69.6%

of individuals surveyed offer 4 or 5 points to this question, massing a majority of individual's answers in the upper area of the chart. The same is presented by the Box-Plot diagram in the figure below.

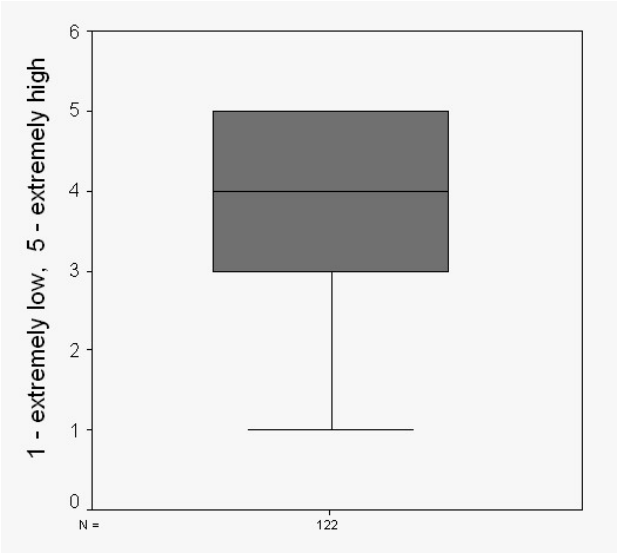

Figure 1. Impact of National Rural Development Programme 2007-2013 over the economic growth –Box Plot chart

CONCLUSIONS

- The banking system plays an important role in the process of absorption of the European funds. Opening of the banks by the beneficiaries or potential beneficiaries of projects, offering of financial and banking quality products and services and at acceptable cost, are incentive factors in the efficient investment of the non-reimbursable funds allotted to Romania by the European Union.
- The important role of banks in supporting and implementing the European projects arise also from this study, in which more than half of the respondents namely 62.5%, appealed to the services of a bank in their steps.
- The "closest"-to-client bank is Transilvania Bank, 18 respondents (30%) appealing to the services of this bank, followed by BRD Groupe Societe Generale and Romanian Commercial bank (BCR). That thing is explainable by the fact that Banca Transilvania has an important network of agencies also in the smaller localities from Romania.
- The most used financial and banking products and services were: supporting credit for pre-financing of the investments provided for in the project (45%), bank bond (22%) and special account for collecting the non-reimbursable grant within the project (20%).
- As concerns the satisfaction of the respondents concerning the help offered by the financial banking institutions, for supporting their projects, over 81% of the answers focus on the upper area of the degree of satisfaction, indicating the fact that the Romanian bank system is well perceived by the beneficiaries of rural development projects. It may be ascertained however, a certain discontent concerning the cost of the packages of services and the packages of products offered by the banks, 26 persons stating that such costs seem high. More than a half (34 persons) considered them "accessible", and neither of them stated that they are "small".

ACKNOWLEDGEMENTS

This work was supported by a grant of the Romanian National Authority for Scientific Research and Innovation, CNCS – UEFISCDI, project number PN-II-RU-TE-2014-4-1134.

REFERENCES

BRADY M., KELLERMANN, K., SAHRBACHER C., JELINEK, L., 2009: Impacts of decoupled agricultural support on farm structure, biodiversity and landscape mosaic: some EU results, Journal of Agricultural Economics 60(3), 563–585

CUNDER, T., 2007: The role of rural development policy in environmental and land management in Slovenia, Journal of Central European Agriculture 8(2), 237–242

FEHER, A., HANDARIC, A.G., 2016: Competitiveness, innovation and rural areas development under the European funds, Abstracts/Journal of Biotechnology 231 (10), S75

PELUCHA, M., KVETON, V., SAFR, K., 2017: Theory and reality of the EU's rural development policy application in the context of territorial cohesion perspective—The case of the Czech Republic in the long-term period of 2004–2013, Land Use Policy 62, 13-28

RAICOV, M., FUCHS A.N., FEHER, A., ADAMOV, T.C., 2016: Evaluation of impact of the National Rural Development Programme 2007–2013 on the rural space from Romania, Abstracts/Journal of Biotechnology 231 (10), S75-S76

ZIMMERMANN, A., BRITZ, W., 2016: European farms' participation in agri-environmental measures, Land Use Policy 50, 214-228

MINISTRY OF AGRICULTURE AND RURAL DEVELOPMENT, 2015: Programul Național de Dezvoltare Rurală 2007-2013 (National Programme of Rural Development), Version XVIth, Avaible at: http://www.madr.ro/docs/dezvoltare-rurala/PNDR_2007-2013_versiunea-septembrie2015.pdf. Accessed 11st January 2017

MINISTRY OF AGRICULTURE AND RURAL DEVELOPMENT, 2016: Programul Național de Dezvoltare Rurală 2014-2020 (National Programme of Rural Development), Version IVth, Available at: http://www.pndr.ro/implementare-pndr-2014-2020/pndr-2014-2020-versiune-aprobata.html. Accessed 11st January 2017

Review on Agriculture and Rural Development 2017 vol. 6 (1-2) ISSN 2063-4803

EFFECT OF INTERNATIONAL TRADE RELATIONS ON AGRI-FOOD TRADE

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ABSTRACT
Nowadays, production of goods increases hugely all over the world, resulting an enormous increasing in international trade. Trade in industrial goods grows at a large rate due to trade liberalization, while agriculture is one of the most vulnerable sectors all over the world. However, barriers of agri-food trade were reduced or eliminated; there are still many obstacles to the totally free trade of agricultural products (e.g. restrictions, safeguards, bans, limitations, etc), especially in the European Union. Besides the WTO's liberalization pressure and its multilateral negotiations, there are a lot of countries that have signed bilateral agreements. In this study, it was examined, what kind of bilateral agreements were entered into force by the EU and how was international agri-food trade influenced by these bilateral agreements as well as by restrict measures. For this, secondary data were analyzed by different statistical methods and the effect of trade measures was characterized by using this results. From the results it can be concluded that EU has preferred different agreements with the various country groups as well as EU has applied different kind of agreements in different eras. The EU's average growth rate of food trade and average share of food trade is highly variable by partner countries. Bilateral agreements have not always caused trade growth between the two partner regions. The EU's restrict measurements effect the EU's foreign trade, because these restrictions are applied to meat products and these commodities are imported the less in the EU.

Keywords: agri-food foreign trade, bilateral agreement, EU, USA, restrict measures, average growth rate

INTRODUCTION

As it is known agriculture is one of the most vulnerable economic sectors all over the world. Nevertheless, agricultural exports have several economic benefits. It can help to stimulate a wide array of industries linked to agriculture, including transportation, processing, and farm input suppliers. Furthermore, most of the future growth in food demand is expected to occur in developing countries (MCMINIMY ET AL., 2015). International trade in agricultural and food products has increased sharply during the past decades, mainly due to the increased trade liberalization, population growth, urbanization and changing diets (ANDERSON, 2010). Although currently the European countries have the largest share of world food exports, agri-food exports from other underdeveloped countries are expanding rapidly (especially from low-and middle –income countries in Africa, Asia and South America) (AKSOY, 2005). At the same time, there are many countries that can not overcome the barriers to export their products, so they promote the free movement of products on the global market. Nevertheless, there is no country that freely allows the import of certain products. Protective measures of agricultural protection are present in all countries, but they are of particular significance in the agrarian policy of the countries of Europe and the United States. Agriculture sector has a particular importance to the member states in EU, because it has a significant share in the total EU budget. While the United States primarily implemented protectionist measures that favours the stimulation of exports (offensive protectionism), the EU applied mainly defensive protectionism (limiting imports) (MARKOVIC AND MARKOVIC, 2014). There is a long-standing trade dispute between the US and the EU. They have different opinion on agriculture, particularly with regard to environmental protection, consumer safety, animal welfare and farming support. EU and US farmers still operate under very different conditions and product different

products (DIAMAND AND SCHIMPF, 2016). One of the barriers to negotiations between the US and EU involves the EU's safeguards against genetically modified organisms (GMOs) including genetically modified foods and crops. The EU restricts or outright bans the import of GMO products and requires the labelling of all GMO foods (Lewis, 2014). The US has no such labelling requirements for GMO foods. Furthermore, the EU bans imports of hormone-treated meat from the US and restricts most meat exports to the European Union to a limited quantity of beef imports that are certified as produced without the use of hormones. Even so, the US is the largest importer of EU agricultural products and it trades particularly with the EU15 member states. However, patterns of agricultural trade with the US vary greatly between these EU member states. The largest agri-food exporters to the US are France, Italy, Spain, the Netherlands as well as Germany, and the largest importers of US products are Germany, Spain, the Netherlands and the UK. Although it is often stated that tariffs are not a major barrier to trade between the US and EU, both sides set tariffs on agricultural imports. The EU applies much higher tariffs on all products than the US. The average agricultural tariff of EU is 30%, well above the average US agricultural tariff of 12% (www.usda.gov). In case of tariffs there are many differences in regulation, safety measures, procedures and monitoring between the US and EU (DIAMAND AND SCHIMPF, 2016).

Despite, the EU is one of the most open economies in the world with number of trading partners. It is the largest trading partner almost for 60 countries, while China and the US is a trading partner for 36 and 24 countries. European goods and services account for 35% of the EU's GDP (MAZURE AND TILTINA, 2015). Approximately 90% of world future demand will be generated outside the EU. The EU's aim is to expand the trade relations more widely, because trade in goods and services makes a significant contribution to increasing sustainable growth and creating jobs. The EU trading partners benefit from preferential tariff access to the EU given that the EU has concluded free trade agreements with more than 30 countries. Further aim is to negotiate new form of free trade agreements with certain countries. These agreements could generate 2.2 million new jobs as well as contribute to the EU's GDP with EUR 275 billion. Besides that trade agreements can have many other benefits such as opening new markets for EU goods and services, increasing investment opportunities, making trade cheaper and faster, making the policy environment more predictable and last but not least supporting sustainable development (http://ec.eurpoa.eu). Such free trade agreements are for instance the EU-Canada Trade Agreement (CETA), the EU-India Free Trade Agreement as well as the so called DCFTA with Mediterranean region, with special attention with regard to the sensitive products (such as agricultural products). Sensitive products are treated also specially in case of EU's agreement with the MERCOSUR countries. In order to wide its relationships with Central and South-American countries. In additional, EU support more active and (some new and) updated trade relations with Japan, India as well as ASEAN countries. The Transatlantic Trade and Investment Partnership (TTIP) is the most significant recent EU-US project and will reinvigorate the transatlantic partnership as a whole, beyond its trade aspects (not only with the US but also with other trade partners) (EPP GROUP POSITION PAPER, 2015)

Of, course these agreements and partnerships intend to liberalize agricultural trade and eliminate, or substantially reduce tariffs and restrictive quotas around certain commodities, such as rice and pork in Japan, or dismantle supply management programs that protect poultry, eggs, and dairy in Canada. Even so, on the negotiating agenda are still obstacles to agricultural products, mainly non-tariff trade barriers, including certain sanitary and phytosanitary (SPS) measures as well as Geographic Indications (GI) (MAZURE AND TILTINA, 2015). BURNETT (2015) is of the opinion that multilateral agreements require

successful reforms of global agricultural markets, involving trade liberalization and the reduction of domestic subsidy programs.

MATERIAL AND METHOD

During this investigation were used data related to EU's bilateral trade agreements and its international trade in foods on secondary databases (Eurostat, Faostat, OECD Statistics). The data were calculated using basic statistical methods (average values, ratios, geometric average, standard deviation, coefficient of variation). Data on international food trade of Eurostat and Faostat from 1992 to 2015 were used to calculate the annual growth rate of exports and imports with various partner countries of the EU during these 25 years. From these data were calculated the average growth rate by countries. This indicator is appropiate to separate out the fluctuations that are caused by other factors (such as political, meteorogical, economic, etc. factors) in certain years. Furthermore, data on share of food exports and imports were averaged (it is possible, because coefficient of variation were almost in all cases below 15 percent). Using these data it can be established, how was the change of food trade affected by bilateral agreements with partner countries. Data on food trade balance of OECD Statistics were used to calculate imports/consumption ratio and exports/production ratio. These data were compared by countries in order to state whether the trade of the limited foods is influenced by EU's restrictions.
The aim of this study is

- to group the EU's bilateral agreements by type and by partner country groups;
- to review the situation and opportunities outside the EU;
- to compare the change and share of international food trade with partner and non-partner countries of the EU;
- to establish the impact of agreements and restrict measurements on EU's foreign trade;
- to put forward suggestions taking into account the future development opportunities.

RESULTS

The EU has a strong, rules-based multilateral trading system with a high level of transparency. The EU manages trade relations with third countries in the form of bilateral trade agreements, which have different names depending on their content. Economic Partnership Agreements with partners such as African, Caribbean and Pacific countries aim primarily at supporting development. Free Trade Agreements with developed countries and emerging economies are economically driven and based on reciprocal market opening. Some Association Agreements are part of broader political agreements. Partnership and Cooperation Agreements are non-preferential trade agreements and part of other broader agreements. As it can be seen in the, EU has preferred different agreements with the various country groups (for instance Association Agreement with Mediterranean countries) as well as EU has applied different kind of agreements in different eras. Furthermore EU has successfully signed a number of bilateral trade agreements with various partner countries such as Canada, Colombia, Ecuador, Iraq, Papua New Guinea and some African countries (Cameroon, Cote d'Ivoire, Ghana, Madagascar, Mauritius, Seychelles, and Zimbabwe). In addition, EU has a number of ongoing trade negotiation processes such as Transatlantic Trade and Investment Partnership (TTIP) with the USA, Comprehensive Economic and Trade Agreement (CETA) with Canada, Free Trade Agreement with Japan, and Trade in Services Agreement (TiSA) negotiations by 23 WTO countries, including the EU. The EU's average growth rate of food trade and average share of food trade can be

seen in table 1 by bilateral partner countries. In case of some countries either the value of growth rate (mainly Mediterranean countries) or the value of share of trade (Russia, Serbia, Ukraine, Egypt, Algeria and Chile) have increased after the agreement (these cells of table are shaded with grey colour).

Table 1. EU's average growth rate and average share of food trade by bilateral partner countries (1992 – 2015)

Country	Date of entered into force	Average growth rate of exports (%)		Average growth rate of imports (%)		Average share of exports (%)		Average share of imports (%)	
		Before agreement	After agreement	Before agreement	After agreement	Before agreement	After agreement	Before agreement	After agreement
Europe									
Iceland	1973	..	106	..	106	..	0.3	..	1.4
Norway	1973	..	104	..	105	..	3.4	..	4.5
Switzerland	1973	..	105	..	107	..	7.0	..	3.5
Andorra	1991	..	101	..	107	..	0.3	..	0.0
San Marino	1992	..	105	..	125	..	0.0	..	0.0
Turkey	1995	135	115	110	110	..	1.8	..	4.1
Macedonia	2004	118	104	98	109	0.4	0.3	0.2	0.2
Albania	2006	122	106	91	113	0.4	0.4	0.0	0.0
Montenegro	2010	112	106	106	97	0.2	0.2	0.0	0.0
Russia	2013	111	77	115	102	9.7	7.1	1.2	1.4
Serbia	2013	112	111	106	103	0.6	0.7	0.8	0.8
Ukraine	2014	116	78	110	109	1.6	1.2	1.2	2.5
Bosnia and H.	2015	109	..	108	..	0.9	..	0.1	..
Kosovo	2016	114	..	113	..	0.2	..	0.0	..
Georgia	2016	111	..	123	..	0.1	..	0.1	..
Moldova	2016	111		95	..	0.2	..	0.2	..
Mediterranean									
Syria	1977	..	103	..	110	..	0.4	..	0.0
Palestine	1997	..	114	..	109	..	0.0	..	0.0
Tunisia	1998	109	106	124	103	..	0.5	..	..
Israel	2000	104	106	109	102	..	1.1	..	1.0
Morocco	2000	106	110	105	106	..	1.2	..	2.3
Jordan	2002	107	112	99	114	..	0.4	..	0.0
Lebanon	2003	104	105	92	110	1.0	0.8	0.0	0.0
Egypt	2004	106	113	87	110	1.1	1.4	0.4	0.7
Algeria	2005	101	109	110	104	2.2	2.7	0.1	0.1
Other countries									
Armenia	1999	149	103	..	109	..	0.1	..	0.0
Azerbaijan	1999	100	101	..	113	..	0.2	..	0.0
Mexico	2000	124	105	120	107	..	0.9	..	0.9
South Africa	2000	106	111	135	109	..	1.0	..	2.6
Chile	2005	97	117	115	105	0.2	0.3	2.6	2.8
South Korea	2015	107	..	106	..	1.7	..	0.2	..
Kazakhstan	2016	112	..	106	..	0.2	..	0.1	..
EFTA	1960	..	106	..	107	10.7	10.7	9.4	9.4
NAFTA	1994	..	104	..	104	20.4	20.4	10.8	10.8

Source: Edited and calculated by own based on data of *Eurostat and Faostat*

However, there are some countries where the average growth rate of exports (Turkey, Macedonia, Albania, Ukraine, and Armenia) or the rate of the imports (Montenegro, Israel, South Africa, and Chile) or both exports and imports (Russia, Tunisia, Mexico) were decreased after the agreements (shaded with diagonal lines). In Russia and in Ukraine the growth rate of food exports, while in Montenegro and in Moldova the growth rate of food imports show declining trend year by year. Thus, bilateral agreements have not always caused trade growth between the two partner regions. The average growth of food exports and imports with the partner countries vary between 1-10 percent per year, but this data is almost the same in case of ongoing negotiation countries and in case of other countries. There are only a few exceptions, where the growth rate is higher than this average (Turkey, Macedonia, Tunisia, Russia, and China). A relatively large share of EU's food exports go to Switzerland (7%), and Russia (7.1%) (this latter has decreased after entering the agreement), and in case of other partner countries the share of food exports and imports are larger, than in countries which have not applied the agreement yet.
In EU there are many obstacles to the totally free trade of agricultural products. The EU bans the imports of GMO products, hormone-treated meat and restricts most meat exports to the European Union. While the US has no such restrict measures for foods imported from the EU. In table 2 there are data related to trade of some goods which imports are limited to the EU. These data were examined in three countries (EU, USA, and China).

Table 2: Trade balance of some foods (Thousands tonnes)

	Crops	Beef and veal	Pig meat	Poultry meat	Dairy
EU					
Production	339 391	7 857	23 441	13 605	63 467
Imports	34 665	304	15	828	188
Consumption	339 662	7 765	21 371	13 036	60 931
Ending stocks	44 254	483	225	500	550
Exports	40 815	393	2 085	1 397	2 644
Trade balance	6 151	89	2 070	569	2 456
Imports/consumption (%)	***10.2***	***3.9***	***0.1***	***6.4***	***0.3***
Exports/production (%)	***12.0***	***5.0***	***8.9***	***10.3***	***4.2***
USA					
Production	583 663	10 342	10 956	20 532	31 536
Imports	8 803	2 106	675	77	357
Consumption	442 997	11 376	9 344	17 414	30 715
Ending stocks	97 493	317	283	480	855
Exports	133 756	1 027	2 257	3 111	1 129
Trade balance	124 953	-1 079	1 582	3 034	772
Imports/consumption (%)	***2.0***	***18.5***	***7.2***	***0.4***	***1.2***
Exports/production (%)	***22.9***	***9.9***	***20.6***	***15.2***	***3.6***
China					
Production	550 184	6 989	54 870	18 180	42 474
Imports	115 422	557	916	408	1 175
Consumption	653 203	7 504	55 691	18 166	43 224
Ending stocks	272 416	0	175	0	
Exports	1 893	41	295	422	13
Trade balance	-113 528	-515	-621	14	-1 162
Imports/consumption (%)	***17.7***	***7.4***	***1.6***	***2.2***	***2.7***
Exports/production (%)	***0.3***	***0.6***	***0.5***	***2.3***	***0.03***

Source: Edited and calculated by own based on data of *OECD Statistics*

As for export/production ratio the US exports a higher proportion, while China a lower proportion of their products than the EU in case of all examined commodities. The share of each exported food type is almost the same proportionally in the EU and in the US. As for the imports/consumption ratio it can be concluded that it is very variable by the three countries. Share of imported foods for consumption are different by types of foods in each examined country. In the US a relatively high proportion of meat consumption is provided from import (especially beef, veal, and pig meat); while in China primarily the crop, beef, and veal imports meet a portion of domestic demand. A relatively high proportion of EU's crop consumption is provided from import, while import of meats and dairies contribute to the domestic consumption negligibly. Consequently, the EU's restrict measurements effect the EU's foreign trade, because these restrictions are applied to meat products and these commodities are imported the less in the EU.

CONCLUSIONS

EU has preferred different agreements with the various country groups, as well as EU has applied different kind of agreements in different eras. This influences the EU's trade with each partner country. The EU transacts a higher volume of trade with the countries with which it signed an agreement with deeper content. The EU's average growth rate of food trade and average share of food trade is highly variable by partner countries and these indicators are not explained by the fact that these are the EU's partner countries or not. Bilateral agreements have not always caused trade growth between the two partner regions. The EU's restrict measurements influence the EU's foreign trade, because these restrictions are applied to meat products and these commodities are imported the less in the EU. For the future, it might be considered to initiate more multilateral negotiations, because these are much more efficient in terms of individual countries. If the EU opens up its markets for meat products, much more meats would be imported from the third countries, especially from the US. However, more meat products of EU might be exported, because a higher amount of surplus would remain. According to estimations the TTIP agreement will increase food and agriculture imports from the US.

REFERENCES

AKSOY M. A. (2005): The Evolution of Agricultural Trade Flows. In Aksoy, M. Ataman, – Beghin, C, John (Eds.): Global Agricultural Trade and Developing Countries; The World Bank: Washington, DC, USA, 2005; pp.17–34.

ANDERSON K. (2010): Globalization's Effects on World Agricultural Trade, 1960–2050. Philosophical Transactions of The Royal Society B Biological Sciences; Vol. 365, Issue 1554, September, 2010; pp. 3007–3021.

BURNETT J. W. (2015): Moving to A Free Market Agriculture Policy. Americans for Limited Government Foundation; April 2015

DIAMAND E., SCHIMPF M. (2016): Trading Away EU Farmers. The Risks to Europe's Agriculture from the TTIP. TTIP Farming Report; Brussels; April 2016

EPP Group Position Paper on International Trade. EPP Group in the European Parliament Press and Communications Service Publication Team. Accessed online at http://www.eppgroup.eu/system/files_force/publications/2015/06/Final.EPP_Position_Paper_Trade_EN.pdf downloaded on 30 May 2016

LEWIS C. (2014): The TTIP: A Very Scary Proposal. The Huffington Post. Accessed online at http://www.huffingtonpost.com/courtenay-lewis/the-ttip-avery-

scary-proposal_b_6069532.html. downloaded on 9 June 2016
MARKOVIC I., MARKOVIC M. (2014): Agricultural Protectionism of the European Union in the Conditions of International Trade Liberalization. Economics of Agriculture; Vol.61, Issue 2; April-June 2014; pp. 423-440
MAZURE G., TILTINA S. (2015): Export-Import Dynamics within the European Union Trade Policy. 2015 International Conference "Economic Science for Rural Development" No37 Jelgava, LLU ESAF, 23-24 April 2015, pp. 268-279
MCMINIMY M. A., COWAN T., GREEN J. L., JOHNSON R., SCHNEPF R. (2015): Major Agricultural Trade Issues in the 114th Congress. Congressional Research Service Report; February 10, 2015; pp.1-3

Review on Agriculture and Rural Development 2017 vol. 6 (1-2) ISSN 2063-4803

PRESENCE AND ROLE OF MINER MENTALITY IN THE SETTLEMENT DEVELOPMENT OF RECSK

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ABSTRACT
Recsk became central in the non-ferrous metal mining of the Mátra hill. The change of regime in Hungary and shutdown of the ore mine had a lot of negative impacts on social and economic sectors. Unemployment is high in this area and there are only a few profitable companies. The mining had affected significantly on community spirit. Nowadays mining is very uncertain development opportunity in the life of the settlement.
In my recent study I strive to explore new ways and chances, which clearly point to the complexity of the situation. I used several research methods of social sciences. In my study I compare the concept of miner spirit before deterioration of mining, its presence and role in the settlement development.
I formulated a few preliminary assumptions. The mining spirit has less prominent force in community shaping. According to changing social environments, future visions of the settlement and community have been transformed.
Recsk is located at Northern Hungary, Heves County, Pétervására small region. In my study I made practical and complex surveys (individual and focus group interviews, widespread questionnaire examination, calculations, field trips, overview of professional studies)
Changes generated negative economic and social situations, but Recsk has important role in the neighbourhood. The interviews also confirmed deep social and existensial crisis in the life of people. The mining such as future potential possibility is far from younger age group. The mining spirit still lives by the traditions of the village. Based on my variance and other calculations, experience, binding to the settlement had a positive result, but it is not in relationship with miner spirit in the local community.
Based on the results, the miner mentality concerned several society groups. It is necessary to stabilize community and social circumstances. Nowadays mining spirit is existing in local population, but mostly in cultural field. Recsk needs to wide community cooperation and develop its partnership interactions.

Keywords: Recsk, miner mentality, settlement development, community, social effects

INTRODUCTION

Mining such as a work system had a prominent role for a whole time in the life of continents and countries. This sector was revived very much by technology development. Mining of Hungary had a bigger role before 1989. Gyöngyösoroszi and Recsk became central regions for the non-ferrous metal mining in the Mátra hill. Life and view of Recsk is in connection of industry and ore mining, and nowadays many people think the same. Decreasing of negative mining effects has been tourism developed in the neighbourhood.
The mining is a very complex sector. Primarily it provides raw materials for industry, later it will be usable for processing. Mining has a lot of attachment points so it determined view of areas and regions. Thus were formed „mining settlements", such as Tatabánya, Oroszlány, Pécs, Bükkábrány etc. and it was in connection of developing of institutions, culture, community. Mining such as part of national economy belongs to primary sector (GOODLAND, 2012).
Decades ago there were similar aspects in Recsk Ore Mine. In the place of Mining Site II stopped underwater suction before the millennium. Thanks to this method, the output of thermal wells increased. Tourism developed in the last 15 years. Geological conditions have been changed, and it affected for example pressure conditions (Mátraderecske – carbon dioxide bath) (CSIFFÁRY, 2009).

Social effects of mining

The mining affects directly environmental and economic sections, but it has large impacts on other aspects of society. Each of the operation, as well as the closure or shutdown of mine, or the recultivation affected workers, local organizations, and residential community. During the extraction and processing, if it is operable and profitable mine, then this could be a major initiator of social processes.

The positive economic impact of mining – in addition to the contribution to the export income of the country -, appears in the local economy. It is provided job for many people, ranging from engineering works to office projects. Then it became necessary to train specialists that brought the development of education.

Along with the improvement of living and working conditions can be observed positive immigration rate, increase of number of the resident population and births in the settlements.

Social-local mining traditions can strengthen community of residents. For example, before changing of the regime, mining companies supported significant the institutions of the settlements (child garden, school etc.), sport associations, youth and cultural programs. Over and above, these companies had own cultural, sport, other clubs and associations.

Workers could be participate in official or private vacation of labor union and in community programs. Since the late eighties, after changing the regime, it was observed negative social effects. The mines were closed, and by the reason of unsuccessful privatization and downsizing of staff, started contrary processes. Massive emigration has been started from these areas, especially among young people.

Over time, the resident population in Recsk is aging continuously. Allowances have been ceased which have boosted the local residential communities, culture, youth and sports life. Although today is existing, or surviving a few traditionalist groups, that preserve the mining traditions, nevertheless it has much less unifying and motivating force.

Due to the economic problems, deep social troubles have emerged in these settlements.

The unemployment rates are high and there will be a layer int he society who can not work.

Latter-born generations feel hopelessness. Because of the less income, public safety will be weaker and the settlements will be less livable.

Miners had early retirement. It served the purpose that can compensate for a much greater negative impact of the difficult and dangerous mining conditions on health (SISKÁNÉ, 2008).

The importance of mining in settlement development

After the change of regime, the economy of the former mining settlements declined. They were not able to recover from the bad situation in this twenty years, and huge debts were also accumulated. Nowadays these are backward areas, their catchig-up must be helped.

In rural development such areas are called peripheral, semi-peripheral zones.

These are socially typical: the aging of the settlements, significant migration, and high unemployment rate. The role of settlement and rural development is to help promote these regions both economically and socially. National measures are also important here.

Mining establishments which are built earlier and are in good condition, should be used for other purposes. Cooperation between the different segments should be strengthened. (SISKÁNÉ, 2008, MEGGYESI, 2006, G. FEKETE, 2013)

MATERIAL AND METHOD

Short display of Recsk Settlement

Recsk is located at Nothern Hungary, Heves County, Pétervására small region (Figure 1). The village lies on the northeast part of the Mátra Hills. Pétervására is the smallest town in Heves County. Recsk is 20 km far from Pétervására. There are weak transport and other functional connections between the settlements. Recsk is located along the No. 24 Highway and railway line between Kisterenye and Kál-Kápolna stations. First of all, it seems to be these are preferential transportation conditions, but 24 Highway has bigger touristic relevancy and the passenger traffic on the railway line was ended in 2007. Communal services are available in Recsk, but these enterprises struggle with quality problems. The municipality had notable attraction zone earlier, nowadays it spreads for 4-5 villages in the neighborhood. The closure of Recsk Ore Mine and other changes generated negative economic and social situations.

Figure 1. Pétervására small region
Source: http://www.pvkisterseg.hu/new/pic/terkep.jpg

Methods

In my recent study I strive to explore new ways and chances, which clearly point to the complexity of the situation. I used several research methods of social sciences. In my study I compare the concept of miner spirit before deterioration of mining, its presence and role in the settlement development.

In the last years I was several times in Recsk, when I personally kept in touch with inhabitants. In my study I made practical and complex surveys (individual and focus group interviews, widespread questionnaire examination, calculations, field trips, overview of professional studies).

12 individual interviews were made, the focus group interview involving 5 people.

Widespread questionnaire examination

It was necessary to make a complex viewpoint system for workmanship of settlement situation analysis. The questionnaire I had consisted of 17 questions. The questions focused on the relationship between the ore mining and settlement, the current situation of the village and its future possibilities. The questionnaire research took place on several

occasions between December 2015 and January 2016. 221 questionnaires were included in the database.

RESULTS

The social situation of the settlement

The population of Recsk has decreased by more than 400 people since the mines' downturn (population in 2000: 3045 person, population in 2015: 2627 person), and this trend has continued since. This is comparable to the national average. It exemplifies the lives of settlements that have to be calculated with a decreasing number of people by falling down a decisive sector. Natural growth is also negative. The number of deaths is relatively constant, however, due to higher emigration, the number of births gradually decreases.
Unemployment rate has increased until 2010. That year, the first time the public work programs were launched, which provisionally, by certain periods, actually give rise to improvements, but as it is not a value-creating job, it will not solve the settlement problem in the long run. This option does not contribute to raising national income either. The number of registered unemployed does not really reflect real numbers because there are many who can not be registered. There are also many job seekers who are looking for temporary jobs and their families, but since they are not listed in the statistical system, this indicator always shows less than the real value.

Conception of miner mentality

Miner mentality does not have concrete and fixed conception. It is difficult to be accurately described. Mining and industry were also typical for cities and villages. Mining had a community building effect, and it was stronger in smaller settlements. Through work, families and friends were peope twitted with each other. Special traditions were found in mining. Cultural and community programs have strengthened the community consciousness. They also had peculiarity in music and clothing on feast days. However mining meant very hard work, miner mentality carried also pride.
On the whole, external and internal factors create together miner mentality.

Results of interviews

Participants of individual interviews: two former mayors, former deputy mayor, colleague of family support service, shoe reatiler, deputy director of the primary school, leader of Recskért Hórukk Egyesület (civil asscotiation), leader of the local inn and restaurant, local forester, houswife, old couple who worked by ore mine.
Focusgroup interview: members of the local civil associations, 3 of them worked by the ore mine
All said that the ore mining was decisive in the life of the settlement, mainly because of the traditions and memories. They felt deep social problems. There are less co-operations, only in cultural and civil fields are more. It was observed during the interviews, they thought mining spirit was stronger earlier, today lives only in traditions and culture. With the disappearance of the usual circumtances, uncertain conditions have emerged

Connection of the age and industry, mining

Shutdown of the ore mine caused break in convergent community. Because of the economy, technology and global changes younger generation does not feel strong attachment to their birthplace. This statement is interpretable not only at local level, but also at small region, county and national level. In the variance analysis, I compared the *Age*

factor to the *Local community* factor. Investigating their effect on each other has resulted: in reality, attachment is weaker in younger ages. However, this result can not be clearly demonstrated by the complete questionnaire. This also contributes to the relatively good evaluation of the local community in two categories. Other tendencies can be found in the SPSS research results, but this result is not significant and contains fewer number of elements (F value= 1,527). 127 person think to develop industry and mining in the next 5 years, but age affect answers. It is more common among the elderly to urge the possibility of reopening the mine, which is far behind the attitudes of the younger generation, but the disillusionment does not appear, as industry can be an important employer area for the neighborhood.

Changes generated negative economic and social situations, but Recsk has important role in the neighbourhood. The interviews also confirmed deep social and existensial crisis in the life of people. The mining such as future potential possibility is far from younger age group. The mining spirit still lives by the traditions of the village. Based on my variance and other calculations, experience, binding to the settlement had a positive result, but it is not in relationship with miner spirit in the local community.

Results in connection of society

The view of settlement was completely transformed. There are similarities to what US sociologists have revealed (Lester F. Ward, Franklin H. Giddings, William I. Thomas). The population of basically agricultural areas had to face new hardships with industrialization. In depressed areas, such as in many regions of the Northern Hungarian region, the new problems are deepened.

The local community has developed a community approach that has been a major driver of locality. It is worth to mention, however, that the "spirit" and belonging to the group formed in the socialist era, it could evolve exclusions, because these organizations were basically derived from the top management.

Sociology defines the concept of community: A community of individuals in which people recognize each other, interact with another, meet the needs of members in a way that is organized by them, they have a common purpose and are interdependent.

CONCLUSIONS

Based on the results, the miner mentality concerned several society groups. It is necessary to stabilize community and social circumstances. Nowadays mining spirit is existing in local population, but mostly in cultural field. Recsk needs to wide community cooperation and develop its partnership interactions.

When the ore mining was closed, many professionals left the settlement and migrated to other similar places (for example: Pécs, Mecsek). Occupational stratification was not successful. The unemployment rate is steadily rising, which has further strengthened as a result of the 2008 economic crisis. The shortage of job opportunities has a strong impact on today's generations as well. As a primary cause, this is included in the move. It is similar to the settlements on the periphery.

Mining as a future option is far from age 18-35. Taking this factor into consideration, the future possibilities of the settlement are not imagined.

Nowadays, the notion of **memory community** comes to the fore instead of the experience community, since the second generation of the settlement is already being established in the settlement, where only their grandparents are tied to mining.

This factor lives in traditions and culture, and it is also changing. There are practically few families in Recsken even today, whose ancestors or current residents were not directly involved to the ore mines. It was not just a matter of work, profession, vocation, but more. Among other things, there were several events and holidays for families, for example by the trade union.

In Hungary, former mines had their own trade unions, which provided protection and other opportunities. With the decline of the mining industry, this background has also been greatly shaken, but today there are organizations (eg Mining, Energy and Industrial Workers' Union, Hungarian Mining Association, National Mining and Metallurgical Association of Hungary).

Local patriotic movements concentrate on the operation of local activities and features. There is a need for these, especially in the field of civil society organizations, since they are engaged in activities that the state and the market can not or do not have in their interest as these organizations work on a non-profit basis.

Overall, my point is that the past 15 years and the changes have significantly transformed the community and the population of the settlement and its surroundings. These new challenges will have to face a whole new form.

REFERENCES

BARTA, GY. (2005): The role of Foreign Direct Investment in the spatial restructuring of Hungarian industry. In: Hungarian spaces and places: Patterns of transition (eds.: Barta, Gy.)

BUGOVICS, Z., SZAKÁL, GY. (2006): Szociológia, Budapest, Eötvös Lóránt Tudományegyetem, HEFOP 3.3.1

CSIFFÁRY, G. (2009): Az ércbányászat története a recski Lahócában (1850-1979). Érc- és Ásványbányászati Múzeum Alapítvány, Budapest, 143 p.

G. FEKETE, É. (2013): Integrált vidékfejlesztés, Miskolc, Mickolci Egyetem

GOODLAND, R. (2012): Responsible Mining: The Key to Profitable Resource Development. = Sustainability, 2012/4., pp. 2099-2126.

KOLOSI, T., RÓBERT, P. (1992): A rendszerváltás társadalmi hatásai, Budapest, TÁRKI

KONCZ, G. (szerk.): Vidéki erőforrások hasznosítása, Gyöngyös: Károly Róbert Kutató-Oktató Közhasznú Nonprofit Kft., 2011. (ISBN:978-963-9941-21-2)

MEGGYESI, T. (2006): Településfejlesztés, Budapest, Budapest Műszaki Egyetem

SISKÁNÉ SZILASI, B. (2008): Az egykori bányászfalvak jövője Borsod-Abaúj-Zemplén megyében, Miskolc, Miskolci Egyetem

Review on Agriculture and Rural Development 2017 vol. 6 (1-2) ISSN 2063-4803

TOURISM DEVELOPMENTS IN RECSK-PARÁD BASIN

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ABSTRACT
In the last two decades a lot of settlements in Recsk-Parád Basin developed by the tourism and related services. Even so other villages have completely different image. These disparate advance paths caused large-scale distinctions in life of the settlements. In my recent study I examine tourism developments in Recsk-Parád Basin. I would like to show the importance of the topic during tourism analysis of five settlements. I formulated a few preliminary assumptions. The former industrial settlements were not less able to develop their touristic sector. Due to deteoration of mining and heavy industry, the local tourism has been expanded.
Recsk-Parád Basin is located at Northern Hungary, Heves County, Pétervására small region. These settlements have been analyzed: Bodony, Parád, Mátraderecske, Recsk, Sirok. In my study I analyzed the interactions between the settlements, coordinated the economic, touristic, and social aspects. Over and above I made practical and complex analytical surveys (interviews, questionnaire examination, calculations, field trips, overview of professional studies) and data analysis work.
Tourism developed in Recsk-Parád Basin. In the last decade there are more touristic programs and events. Taking advantages of tourist attractions resulted growths in finances and number of guests. The most visited settlement is Parád, it has the most guest nights in Recsk-Parád Basin and in the small region too. The former industrial settlements have transit tourism and less income from this sector, but the castle in Sirok is very popular and results more positive returns. According to the tourist accommodation possibilities, two lines can be observed. The commercial accommodations dominated in Parád, while the private or rural hospitality has a bigger role in the other villages. Expansion of service-trade sector can strengthen the position of the settlements. There is special spa and resort area here, which needs more partnership cooperation. Common events can develop the possibilities. However these tourist settlements are in good position, but they located in a marginalized region. It plays a decisive role to stabilize their positions, find new development directions and widen their possibilities.

Keywords: Recsk-Parád Basin, rural tourism, territorial development, co-operation

INTRODUCTION

In the last two decades a lot of settlements in Recsk-Parád Basin developed by the tourism and related services. Even so other villages have completely different image. These disparate advance paths caused large-scale distinctions in life of the settlements. Most settlements developed by the tourism, except of some former industrial or mining villages.

MATERIAL AND METHOD

Recsk-Parád Basin is located at Northern Hungary, Heves County, Pétervására small region. These settlements have been analyzed: Bodony, Mátraderecske, Parád, Recsk, Sirok. Special spa and recreation area is located in the area. I formulated a few preliminary assumptions. The former industrial settlements were not less able to develop their touristic sector. Due to deteoration of mining and heavy industry, the local tourism has been expanded. In my study I analyzed the interactions between the settlements, coordinated the

economic, touristic, and social aspects. Over and above I made practical and complex analytical surveys (calculations), field trips, and data analysis work.

RESULTS

For the tourism analysis, I took into account the information on the accommodation facilities of the small region, the distribution of the use in the multilateral division. I used the data of the Central Statictics Office for the analysis. For more than one indicator, there was no data reported for certain periods or settlements, so unfortunately this is a weakness.

Commercial accomodations

The development of the places of the commercial accommodation has undergone significant changes, fluctuations are well visible in the figure. In my opinion, however, the list is incomplete, as only the following settlements could be made in the database: Bükkszék, Parád, Parádsasvár, Pétervására, Recsk, Sirok.

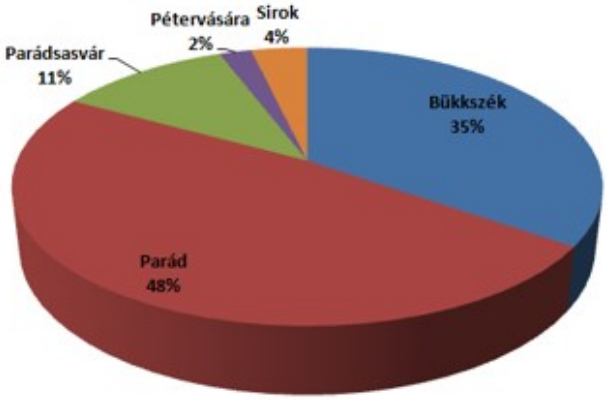

Figure 1. The distribution of of commercial accommodation places in 2013
Source: Based on the data of the Central Statistical Office, own editing.

In 2013, the number of commercial accommodation units was 1383. Almost half of this is related to the settlement of Parád, the second place is Bükkszék, 35%. It is followed by Parádsasvár with 11%. If only the first two are taken into account, it is already 100% practically 83%. With Parádsasvár this is 94%. Although the three settlements are not directly adjacent to each other, but due to their abilities, it is no coincidence that these three settlements appear predominantly.

There is a popular holiday district in the area, which is becoming increasingly popular for these settlements. The individual settlement conditions determine the establishment of accommodation in the villages. In the case of Parád, Parádsasvár and Bükkszék, health tourism gives the decisive character. We have to talk about therapeutic baths and water in these cases. They are built on these hotels. Commercial hotels also include hotels and spa hotels.

Erzsébet Park Hotel *** Superior operates in Parád, Parádsasvár Castle Hotel is located in Sasvár, and Salvus Pension is of great importance in Bükkszék. These settlements largely build on the established health tourism. It is important to mention that in recent years Mátraderecske's mofetta is also of paramount importance in terms of medical tourism. The Parád hotel is closer to Parádfürdő in the settlement, which is relatively close to Recsk.

The number of commercial accommodation units has been decreasing. In the Pétervásárai small region numbers of commercial accomodations were 15 piece in 2015. The decline is

also due to the collapse of the global economic crisis in 2008, so the smaller units that could not survive had to close. The crisis has an impact on tourism as well as the number of paying guests, resulting in less revenue from both the accommodation providers, the associated service units and the local governments.
As with the number of units, a relative decrease is to be expected, this can not be said with the exception of one or two breaks in the number of guest nights. A major breakthrough was seen in 2004 at overnight stays over 100,000. The second biggest fall is seen in 2007. In this case, another dual effect can be perceived. Bad weather conditions have a negative impact on tourism, and this trend may have been the cause of the economic crisis. Interestingly, however, there was an increase until 2011, it was a downturn, though not as high as before. The total number of guest nights is growing steadily over the area.
The central role of Parád can be observed, as more than half of the guest nights are given by this settlement. With Parádsasvár again, it can be said that in more than 2/3 of the small region 2-3 settlements give the most important indicators of tourism. The few inhabitants, far away, with no tourist attractions, are completely out of this sector.

The number of periods spent is relatively short, the number of rotations is high. It is typical that arrivals do not spend more than 5 to 6 days in the settlements where they stayed. In this case, the summer period is most important. Only time spent on medical care may be longer than the time spent. The number of guests increased by nearly 10 thousand during the 15 years.

Rural accomodations

The capacity of commercial accommodation in the Pétervásárai small region exceeds the number of village accommodations. Village accommodation is mostly operated by families, mainly for those settlements where tourism is not dominated, this type of service activity is complemented by their livelihoods. Until 2009, we can talk about a relative increase, while in 2010 this trend has dropped significantly. With the decrease of the number of guests arriving, the difficulty of livelihoods and the emigration of young people, the older age group is the one who maintains these simpler hotels. If migration and aging are high, then older people can not deal with it for a while, for their health or other reasons. The decline can be attributed to this as well as to the crisis.

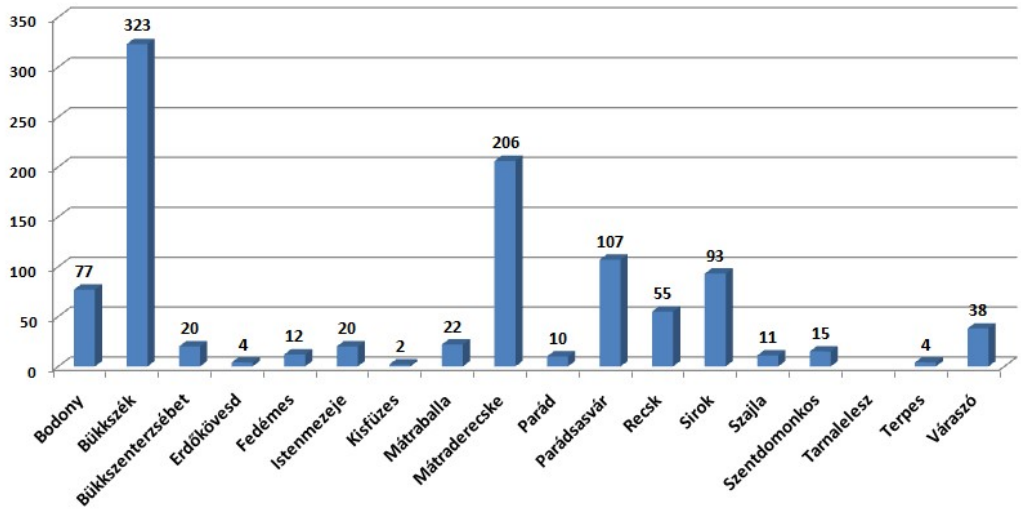

Figure 2. The distribution of the number of rural accomodations places
Source: Based on the data of the Central Statistical Office, own editing.

Here the tendency is reversed with regard to capacity. Parád is no longer playing the leading role in this field. Bükkszék is predominantly the decisive one, which far exceeds the others. Bükkszék has a great tradition of bathing, but outside of the Salvus Panzió, a large hotel has not yet settled in the settlement, so it is typical that they prefer to settle down at the settlement level. The other important settlement is Mátraderecske, which thanks to its mofetta and the beach bath. It is desirable that in the case of Parádsasvár, the proportion of commercial accommodation was 134, while the number of rural accommodation was 107. Thus, in the case of settlement, an equalization can be observed for both categories.

The number of hotels in rural hotels has never reached commercial accommodation. In 2009, it was much higher than in other years, and this can not be said for other hotels. Practically, up to this year, an increasing growth has to be said. The year 2009 was already considerable in the case of rural accommodation. The downturn in 2010 may have a sharp effect on the previous indicators in the restaurant. Fluctuations are still perceptible.

The number of guest nights does not reach commercial accommodation in any year. The highest was in 2008. Compared to the guest nights of commercial accommodation, this is approx. ten times less. Fluctuations are similar to those seen above. Dominant here is Bükkszék, Mátraderecske and Parádsasvár. With regard to guest nights, it can be said that, overall, Mátraderecske gives the biggest part.

Tourist tax

In the majority of local governments, the revenues from the tourist tax derive from the number of guest nights and guest nights from commercial accommodation. Regardless of the 20 settlements in the small region, unfortunately no complete data was available. From the evolution of the numbers it is well-established that the central role of Parád here is decisive. It follows Parádsasvár, though less than half the proportion in the last two years. The third major settlement is Bükkszék, followed by Mátraderecske.

Territorial differences

Examination of local conditions and differences need to take notice of relevant factors which affect the target area. In this part of my study I examined small region level. I focused on some indicators, effecting Recsk-Parád Basin.

Robin-Hood Index

This is a special version of Hoover index and based on data on income and society. In this calculation I took into consideration of resident population and total settlement internal income.

Table 1. Robin-Hood index

Pétervásárai small region	Total internal income (HUF)	Resident population (person)	Robin-Hood index
2000.	5 533 010 173	24 971	11.51
2014.	14 352 517 905	21 541	6.2952

(Source: Own editing based on datas of Országos Területfejlesztési és Területrendezési Információs Rendszer)

From 2000 to 2014 all internal incomes increased significantly, population declined, so the Robin Hood Index was less. At first, this result would suggest that this was a favorable process, since higher total income is divided into fewer population. In fact, the position of the small region is much more multiple. When we are analyzing data, account should be

taken of the deterioration of the value of money, inflation. Over the past 20 years, negative economic and social processes have taken place in this area, which has considerably reduced the range of small region opportunities. Settlements have much less tax revenue. At the habitancy level, the reduction of real income and purchasing power parity (PPP) are observed.

Table 2. Internal income per capita 2014 (HUF):

Bodony	Mátraderecske	Parád	Parádsasvár	Pétervására	Recsk	Sirok
540 569	759 315	660 578	826 994	670 659	688 851	868 312

(Source: Own editing based on datas of Országos Területfejlesztési és Területrendezési Információs Rendszer)

In this table, out of the analyzed villages, there are other important settlements, centre of the small region (Pétervására) and a touristic village (Parádsasvár). In the last years, internal incomes have been increased.
It seems to be well difference between main touristic (Mátraderecske, Parádsasvár, Sirok) and other settlements. Pétervására can not be attractive. Recsk is located in midfield, if I take attention for its trade and service sector.
On the whole, touristic places have positive states, but possibilities of the small region narrow down.

Concentration index

It is used as an important indicator in economics and regional comparisons. Also known as Herfindahl-Hirschman Index. I have analyzed two key sectors for the calculation of the concentration index. I have analyzed two determinant sectors for the calculation of the concentration index, which have a decisive influence on the small region and are of outstanding significance for the analyzed settlements.

Table 3. Concentration index

Pétervására small region	Retail stores	Catering places
2000	0.092549428	0.092455621
2014	0.107432964	0.08882021

(Source: Own editing based on datas of Országos Területfejlesztési és Területrendezési Információs Rendszer)

The concentration index for retail stores in the Pétervásárai small region in 2000 was 0.092549428, which increased to 0.107432964 by 2014. Fact of the increase was that several reatil shops were closed in the settlements this period (this sector was not strong here anyway).
With the disappearance of shops, it was observed that in those settlements where a stronger / wider retail sector was present, this process had a positive impact. In case of the analyzed settlements it makes a difference. This change did not effect so much retail stores, but in Recsk (it has widespread retail store sector) it was more attractive impulse.
The concentration index for catering places has been falled back. It is a contrary process besides the retail sector. For catering establishments, the concentration index was 0.092455621 in 2000, while it declined to 0.08882021 by 2014. Tourism-related hospitality has widened. After chaging regime mining and industry have been relapsed. Tourism and tourist attraction started to evolve. It was necessary to extend number of

serving and catering places. Not only in tourism-frequented places, but also in less attractive settlements have been apperaed. Indirectly, they were able to connect to this procession, so later not just tourism-related catering facilities appeared.

CONCLUSIONS

Tendencies of hospitality and trade services are showing the characteristic features of the region. The basic services are available everywhere, but they can not cater to the fullest demands. Those settlements where an important route passes, the hospital-trading sector is stronger. This sector is strongly dependent on demand and the number of guests. The run of solvent demand suggests, negative tendencies characterize the settlements of the small region.

The tourism market of the Pétervásárai small region shows a strong discrepancy based on the four characteristics and on the basis of the visible trends based on the literature. In the case of commercial accommodation, the role of Parád is particularly prominent, while in the case of rural accommodation Mátraderecske, Bükkszék, Parádsasvár. Compared to this, the center, Pétervára, can only play a central role in public administration, and it is not attractive in this area for tourism, economy and industry. The central part of the small region is Parád and its surroundings. I think that occupancy is good on this part. A transition is the area around the leading tourist centers, Recsk, Sirok etc. For them, it is important to make better use of the tourist attractions in their neighborhood. In the Pétervásárai small region, like in the Mátra, there are several places, forests, pleasant surroundings, wetlands and lakes. In addition to shrinking health tourism, increasing attendance based on this may be a solution.

Among the analyzed settlement, Recsk has a special stand. Nowadays in the marginalized communities and regions – as well as in case of Recsk – play a decisive role to stabilise their positions, find new development directions and widen their possibilities. Recsk needs to wide partnership cooperations and develop chance of tourism. In the short term tourism can bring development to the settlement. The most important is to reduce transient modality and to develop its tourist attractions. For the village it can be way out historical and fishing tourism, rock climbing, making the national memorial park more accessible. In accordance with my previous examinations, rural and nature tourism (for example: Búzásvölgyi Fishing Lake and Jámbor Vilmos Arboretum) can be strenghten Recsk.

Expansion of service-trade sector can strengthen the position of the settlements. There is special spa and resort area here, which needs more partnership cooperation. Common events can develop the possibilities. However, these tourist settlements are in good position, but they located in a marginalized region. It plays a decisive role to stabilize their positions, find new development directions and widen their possibilities.

REFERENCES

BAHIA, A.K. (2002): Tourism Developments: Principles and Practices, Sterling Publishers Pvt. Ltd, New Delhi

DÁVID, L. (2011): Magyarország turisztikai régiói, Pécsi Tudományegyetem, Lektorálta: Hanusz Árpád, Pécs, ISBN: 978-963-642-432-9

KONCZ, G., NAGYNÉ DEMETER, D.: Az elérhetőség szerepe a mátrai szálláshely szolgáltatások fejlesztésében, In: Takácsné György Katalin (szerk.): Az átalakuló,

alkalmazkodó mezőgazdaság és vidék: tanulmányok: XIV. Nemzetközi Tudományos Napok: Gyöngyös, 2014. március 27-28. 1657 p.
KONCZ G., NAGYNÉ DEMETER D. (szerk.) (2014): Helyi erőforrások turisztikai hasznosítása a magyar-szlovák határrégióban, Gyöngyös: Károly Róbert Főiskola, 166 p.
239/2009. (X. 20.) Korm. rendelet a szálláshely-szolgáltatási tevékenység folytatásának részletes feltételeiről és a szálláshely-üzemeltetési engedély kiadásának rendjéről
A kereskedelemről szóló 2005. évi CLXIV. törvény
A szolgáltatási tevékenység megkezdésének és folytatásának általános szabályairól szóló 2009. évi LXXVI. törvény

Review on Agriculture and Rural Development 2017 vol. 6 (1-2) ISSN 2063-4803

GENERAL INNOVATION FRAMEWORK AND THE INNOVATION EXPECTATIONS OF RURAL ACTORS

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ABSTRACT
The analysis of the general and the further-on more specific innovation framework targeting the rural area and the rural economy begins by screening the general statistic data and continues by an in-depth investigation of the options and opinions of relevant rural actors at the scale of a well-defined rural micro region, in our case a Local Action Group territory. The choice of the local scale should build on the previously acquired experience in project-based developments and the general high favourability for rural development for the specific region. The moment of the investigation is also an observation choice linked to the specific inputs of information and advice during the sessions of information and animation requested during the formulation stage of the future Local Development Strategies. The moment is highly relevant since it places the overall accessible support framework in the development perspectives and even more, in the formulated development intentions on medium term for an entire territory. The collection of facts and observations about the current state and the developments in the field of Research, Development and Innovation are compared to the real expectations and the development intentions of the local rural actors. The measure of the gap between the nationally programmed instruments and the real developments in agriculture and rural economy indicates the fitness level of the top-down programming approach.

Keywords: innovation framework, rural development, rural actors' expectations

INTRODUCTION

The need for strengthening the innovations' impact in rural development originates in early community initiatives and becomes a supported development opportunity for the first time in the EU's National Rural Development Programmes (NRDPs) 2007-2013. Although not introduced from the very beginning (EIP-AGRI, 2012) other than a transversal priority it was later incorporated as part of the Rural Development Programmes (RDPs) and supplemented with funds for dedicated interventions (Romanian NRDP 2007-2013, 2012). The current layout of the programmes, namely the EU's 2014-2020 RDPs and the Romanian NRDP (Romanian NRDP 2014-2020, 2016) further include the European Innovation Partnership for Agricultural productivity and Sustainability as a core component for the innovation support designated to smart rural areas. The overall approach of the innovation at national level is rather focused on spinning business and mainstream sectors with no particular emphasis on rural or agriculture other than the dedicated interventions pointing to the bioeconomy. The current Romanian RDP has directed the support for innovation and transfer of innovative products and process mainly towards a sub-measure - sM 16 Support for cooperation (Romanian NRDP 2014-2020, 2016) which is still inaccessible due to a long delayed official launch. On the side of the rural actors and farmers' communities the demand is not only present but also relatively well formulated as highlighted by the findings of the present paper.

MATERIAL AND METHOD

The localised data is collected and analysed by interview survey as primary research method. Bridging with the national relevance and findings was performed by secondary research based on data from official statistics sources selected and compiled by secondary analysis for the relevant variables (NIS, 2017). No qualitative methods were employed in order to induce a maximum of objectivity strictly linked to findings and observations.

RESULTS

Within the precise target of fixing the current expectations and the development intentions linked to the transfer of innovation at the most local scale a screening of the national framework is required. In this respect, we will pinpoint the recent evolutions, where applicable and relevant capturing almost two decades of changes, in line with a selected number of indicators as followed by the methodology of the Community Innovation Survey (CIS, 2016). The heterogeneous series will capture the evolution of the number of units with research and innovation activities, the number of innovative companies with focus on the West Region where the surveyed LAG is situated, the turnover evolution of the innovative companies in Romania where the focus goes for the SMEs, the typology of the innovators and its evolution since 2002 and the selected typologies of RDI projects for agriculture and agricultural sciences.
The evolution of the total number of units developing research and innovation activities over a period of eighteen years is presented in the *Table 1* and illustrated graphically in *Figure 1* bellow.

Table 1. Units with Research and Development activities by sectors, 1993-2010 (no.)

Sectors		Total	Business sector	Governmental sector	Higher Education	NGO
Years	**1993**	617	460	120	37	-
	1994	591	452	105	34	-
	1995	615	454	120	41	-
	1996	616	455	122	39	-
	1997	645	496	109	40	-
	1998	643	493	114	36	-
	1999	626	473	109	44	-
	2000	601	439	110	52	-
	2001	609	424	116	69	-
	2002	607	409	114	84	-
	2003	719	488	120	86	25
	2004	753	523	120	79	31
	2005	806	563	124	85	34
	2006	884	559	177	108	40
	2007	787	506	165	86	30
	2008	775	491	164	103	17
	2009	667	426	134	97	10
	2010	660	410	129	102	19

Source: National Institute of Statistics, TEMPO Online data series, interrogated 04.2017

As general observation it is notable, and to a certain extent, unexpected that the major changes in the peak period before the crisis were induced by the shifts in number in the public sector. The end of the Romania's pre-accession to EU led to an unnatural growth from 124 to 177 units in the governmental sector in a single year that washed away during

the next half decade. Other than this evolution the general trend is set by the business sector as observed in *Figure 1*. Also, worth mentioning that the higher education continued the growth recorded at the beginning of the millennia and managed to sustain the growth even during the crisis years (2008-2010).

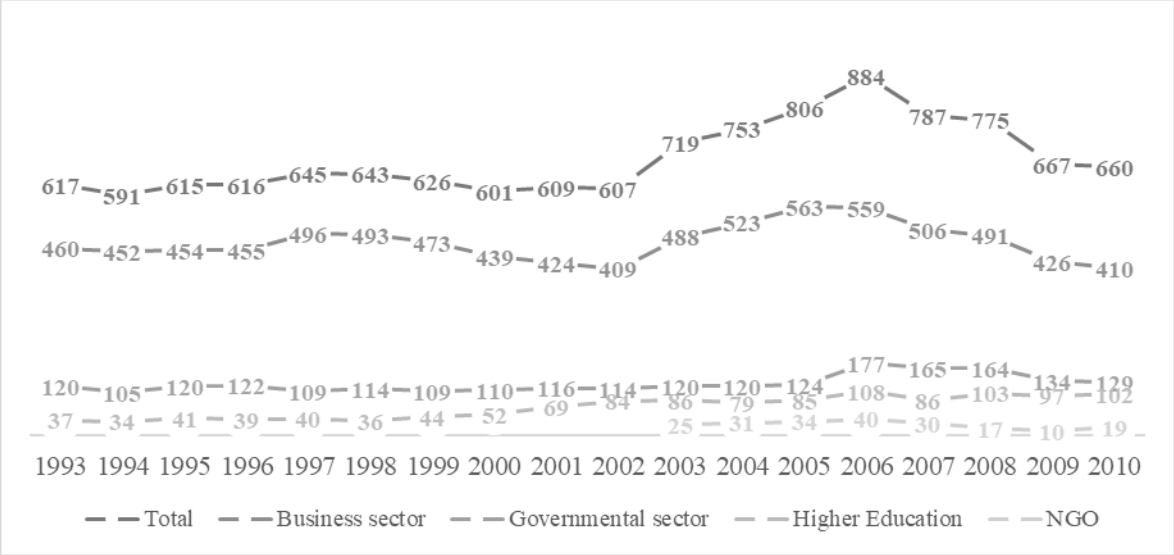

Figure 1. Entities with RDI activities in Romania, 1993-2010 (number)
Source: Based on data from National Institute of Statistics, TEMPO Online data series, interrogated 04.2017

Contrary to the general belief and the common knowledge in the region the number of innovative companies is rather lagging behind other regions in the country. If the relative and absolute figures regarding the IT&C companies and other companies involved in high tech and automotive parts active in the West Region is considerable larger than in most other regions of the country in 2014 only 5% of the innovative companies in Romania were placed and still active here. As presented in *Table 2*, this share is a decrease with more than 100 companies over the past decade while the number of non-innovative companies increased by more than 10% to the reference initial year of the period.

Table 2. Innovative companies at national and regional level, 2002-2014 (no., %)

		Years						
		2002	**2004**	**2006**	**2008**	**2010**	**2012**	**2014**
Total	**TOTAL**	23404	26024	28488	29979	26330	28866	28380
	WEST Region (%)	11%	10%	10%	10%	10%	9%	10%
	WEST Region (no.)	2481	2723	2959	3002	2532	2672	2724
Innovative companies	**TOTAL**	3983	5171	6013	9986	8116	5968	3645
	WEST Region (%)	7%	7%	5%	6%	6%	6%	5%
	WEST Region (no.)	291	354	329	616	469	384	175
Non-innovative companies	**TOTAL**	19421	20853	22475	19993	18214	22898	24735
	WEST Region (%)	11%	11%	12%	12%	11%	10%	10%
	WEST Region (no.)	2190	2369	2630	2386	2063	2288	2549

Source: National Institute of Statistics, TEMPO Online data series, interrogated 04.2017

The turnover of the companies over the same decade containing both the pre-accession (2002-2007) and the integration period of Romania to EU or the first programming period

as EU member state (2007-2014) allow the observation of uneven evolutions and most likely a high dependency to investments for the innovative companies. As presented in *Table 3* below, the general turnover has multiplied over four times (4.3 times) during the observed period if compared the beginning and the end of the period. For the grand total including all kind of companies the growth was almost linear while for the innovative companies the evolution was rather Gaussian stabilising to a factor three growth at the end of the period. However, if in 2002 the contribution of the innovative companies was representing over 40% (41.53%) in 2014 it represents little over 30% (31.29%). Although the evolution of the total and the innovative companies, particularly the SMEs, is slightly parallel it is interesting to observe the relative stability as share from total of the small and medium enterprises as presented in the *Figure 2*.

Table 3. Turnover of innovative enterprises in Romania, 2002-2014 (Thou. ROL)

	2002	2004	2006	2008	2010	2012	2014
Total							
Total	185.533.699	298.028.917	457.951.764	648.366.728	580.659.532	667.323.194	800.965.586
Small	38.032.185	65.965.454	85.589.822	121.410.952	108.080.006	143.290.933	147.439.300
Medium	39.145.696	67.217.615	94.767.755	146.019.979	148.342.548	161.056.062	174.219.298
Large	108.355.818	164.845.848	277.594.187	380.935.797	324.236.978	362.976.199	479.306.988
Innovative enterprises							
Total	77.051.452	135.533.473	219.737.312	391.459.502	339.489.595	267.691.818	250.620.882
Small	5.482.718	13.245.118	15.522.111	41.972.042	35.314.050	27.921.021	19.799.237
Medium	10.054.396	22.319.117	30.117.481	75.224.154	65.432.493	51.760.922	37.884.374
Large	61.514.338	99.969.238	174.097.720	274.263.306	238.743.052	188.009.875	192.937.271

Source: National Institute of Statistics, TEMPO Online data series, interrogated 04.2017

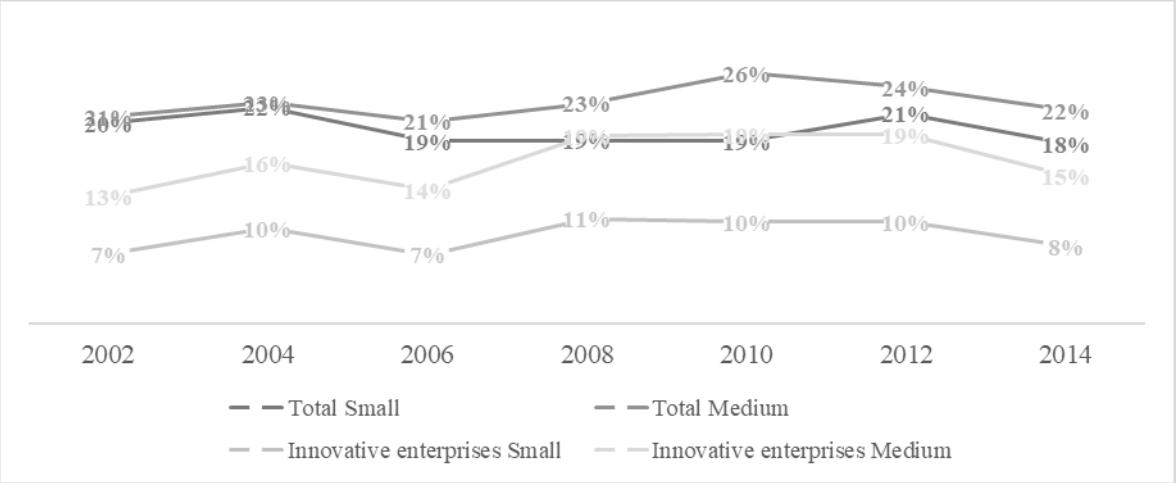

Figure 2. Turnover of innovative SMEs in Romania, 2002-2014 (%)

Source: Based on data from National Institute of Statistics, TEMPO Online data series, interrogated 04.2017

These evolutions observed above can be approached from the inside if we address the typology of the innovators and the evolution of these categories over the same time period (*Table 4*). The most dramatic evolutions regard the innovators with unfinished or abandoned activities where the figures increased fifteen times representing 8% from the total number of innovative enterprises in 2014. Also, the number of successful innovators has decreased by more than half while the number of non-innovative enterprises has increased by one third over the last four years of the observed period.

Table 4. Typology and evolution of innovators, 2002-2014 (no.)

Types of innovators	Years						
	2002	2004	2006	2008	2010	2012	2014
Total	23404	26024	28488	29979	26330	28866	28380
Innovative enterprises	3983	5171	6013	9986	8116	5968	3645
Enterprises with only product and/or process innovation	:	:	:	1951	1137	541	988
Enterprises with only organisation and/or marketing innovation	:	:	:	4079	4353	4162	1805
Enterprises with product and/or process innovation and organisation and/or marketing innovation	:	:	:	3956	2626	1265	852
Successful innovators	3963	5136	5970	5748	3631	1691	1529
Product only innovators	582	472	525	710	635	351	313
Process only innovators	413	1203	1169	1965	955	706	511
Product and process innovators	2968	3461	4276	3073	2041	634	705
Innovators with unfinished or abandoned activities	20	35	43	159	132	115	311
Non-innovative enterprises	19421	20853	22475	19993	18214	22898	24735

Source: National Institute of Statistics, TEMPO Online data series, interrogated 04.2017

Observing the evolution of RDI projects within the frame of agriculture and general promotion of agricultural sciences (*Table 5*) the past five years 2011-2015 have a very heterogeneous evolution. The number of programmes for agriculture according to the NABS 2007 is relatively large considering the entire range of covered sectors reaching over 10% in 2015. However, the evolution over this short and recent period of time has oscillations far too large to be comprehensible. The only pertinent observation with regard to this evolution indicates lack of consistency and respectively an absence of a strategic intervention for both General University Funds or other sources.

Table 5. Typology of RDI projects, 2011-2015 (no.)

Type of RD programmes (NABS 2007)	Years				
	2011	2012	2013	2014	2015
Total, of which NABS programmes:	9518	8394	7421	8143	7872
Agriculture	872	868	1244	737	794
General promotion of knowledge: RD financed from General University Funds (GUF), for:	2161	2073	1033	1066	1663
Agricultural sciences	93	30	32	36	94
General promotion of knowledge: RD financed from other sources than GUF, for:	3502	2898	2496	3460	2763
Agricultural sciences	53	21	48	56	31

Source: National Institute of Statistics, TEMPO Online data series, interrogated 04.2017

The micro-regional scale of the LAG allows its actors to be closely connected to the current and future development opportunities and well placed in the public policy support mainstream. From the total of 189 participants to the animation and information sessions almost one third have responded to the question related to the innovative projects expected in their future LAG. This is figure does not surprise by its low level considering the spectrum of the participants where representatives of local authorities count for 45% of the future members and other NGO representatives, farmers and rural entrepreneurs have a more ardent set of priorities. Of high relevance is the observation that three out of the first five most ranked options representing almost 1/2 (47.46%) of the total number of expressed options are non-agricultural while 1/3 (33.90%) are directly linked to the agriculture (*Table 6*).

Table 6. Innovative projects' intentions/expectations in LAG (no., %)

Options	Number	Share of total respondents
Non-agricultural activities, services, rural business	12	**20.34%**
Public physical infrastructure	10	**16.95%**
Culture and sport activities/events	6	**10.17%**
Information, dissemination and communication	5	**8.47%**
Agricultural infrastructure	4	**6.78%**
Processing (of agricultural outputs)	4	**6.78%**
Alternative energy	4	**6.78%**
Modernising the agriculture	3	5.08%
Environment	3	5.08%
Culture and sport infrastructure	2	3.39%
Conditioning and storage	2	3.39%
Marketing, markets, association and producer groups	2	3.39%
Social activities/events	1	1.69%
Social infrastructure	1	1.69%

Source: Processed primary interview survey data 02.2016

The high level of interest for non-agricultural innovation, moreover for innovative approaches linked to the social aspects, services, public infrastructure, culture and sport coming upfront environment or alternative energy indicates a precise concern for the increase of the quality of life in rural area unprecedented in earlier priority sets and linked to the potential input and impact of the innovation in rural life.

CONCLUSIONS

The findings highlight the realism of the local actors' expectations closely linked with the vocation for development of the territory, the priorities and the strategic goals at a micro-region scale. The innovation framework particularly for agriculture and rural area could further take into consideration the possibility to operate with a finer tuning in terms of territorial and sectoral iterations. The current replication of national and community assumed priorities organised in unique sets and presents for innovation and its transfer as product, process or both appears to be less appealing for the rural local actors. Shifting the target from companies or business entities towards actors and their forms of representation including networks or early unstructured clusters could represent a change with a considerably higher impact in the Romanian rural area.

REFERENCES

EIP-AGRI, 2012, European Innovation Partnership, https://ec.europa.eu/eip/agriculture/en, visited 04.2017

EUROSTAT, Community Innovation Survey (CIS), 2016, http://ec.europa.eu/eurostat/web/microdata/community-innovation-survey

NIS, 2017, Romanian National Institute of Statistics, TEMPO Online data series, interrogated 04.2017

NRDP 2007-2013, 2012, National Rural Development Programme of Romania 2007-2013, http://www.madr.ro/pndr-2007-2013/programul-national-pentru-dezvoltare-rurala-2007-2013.html, visited 04.2017

NRDP 2014-2020, 2016, National Rural Development Programme of Romania 2014-2020, http://www.madr.ro/pndr-2014-2020/implementare-pndr-2014-2020/documente-aprobate.html, visited 04.2017

Review on Agriculture and Rural Development 2017 vol. 6 (1-2) ISSN 2063-4803

RURAL AREAS FROM DEMOGRAPHIC PERSPECTIVE. STUDY CASE POLAND AND ROMANIA

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ABSTRACT
The rural area is an extremely varied area, agricultural area, the area occupied by forests and grazing the surface of non-agricultural lands (Riviera sea, etc.) and rural agglomerations is a separate entity from the urban areas characterized by a high demographic concentration and vertical and horizontal structures.
Being often under the impact of old production systems, characterized by accelerated development and irrational of industry, the countryside has been subject to economic transformation, social and environmental, which mostly resulted in exodus and impoverishment of the rural population. Given this situation, are downright remarkable efforts of developed countries and not only to balance rural-urban ratio, reconciliation and revival of rural areas is kept of unique material and spiritual values.
Rural areas are the result of interactions between man and nature, between interdependencies relations, who are specific to diversity of social actions and their natural environment, between the material and spiritual civilization, which for centuries coexist and evolve in a particular national territory. Image of rural area is emphasized by its size, which is the synthetic expression of social activities that are conducted using specific processes and phenomena of nature. All specific features of rural areas (natural, human, material and spiritual), which define the dimension of rural areas, are highlighted by the following components of the system: territorial administrative, demographic, economic and infrastructural.
European rural area was and is the subject of extensive restructuring processes that were the result of a complex interaction of social phenomena, economic, sectoral and regional transfers. In circumstances where over half of the 27 Member States of the European Union lives in rural areas, and it occupies over 80% of the total territory, rural areas have considerable potential for growth, with a vital social role. Rural population and surface area occupied and the importance of rural life for a country, make the problem of rural development to gain a national and international importance.
In this article the authors presents rural areas as an important part of a country with all its components. The authors elaborated a comparative analysis of rural areas from Poland and Romania from demographic perspective. The analysis was elaborated using indicators like population density, population structure by gender and age, migrations of population, relying on data from national and european statistics.

Keywords: rural areas, population, Poland, Romania

INTRODUCTION

Rural area covers the area belongs the communes and periurban areas of cities or municipalities in which runs activities falling under agricultural production, processing of agricultural products, forestry, fisheries and aquaculture, as well as craft activities, craft and small industry and tourism services and leisure on countryside (MATEICA, 2010).
Demographic processes in rural areas are characterized by a certain dynamics, and the human factor in these areas is differentiated spatially. It is possible to distinguish peripheral areas, where generally there is little social mobility and urban areas with high intellectual and occupational potential (BRAD ET AL., 2011).

In rural areas demographic processes are characterized by phenomena such as the size and structure of the family, its fertility, the occurrence of multiple generations and the missions that children should fulfill (MATEOC-SÎRB, 2002). Rural families live not only in symbiosis with nature, but in the process of its creative processing create new values. In turn, the rural population, bound by blood ties, produces a specific social climate that affects the character of the farm.

The rural family is usually associated with the household and the farm, where the process of extended reproduction takes place, allowing the continuity of the economy and the multiplication of property goods. But the village is not only an agricultural family, but more and more often the other professions necessary for the local environment. This phenomenon leads to multifunctional development of rural areas.

MATERIAL AND METHOD

Studying different sources from the specialized literature, mentioned in the references section, followed by data processing and analysis, the authors of the article, want to highlight the similarities and differences between rural population from Poland and Romania.

RESULTS

The village as a local environment was always inhabited mainly by farmers, although this original feature of population homogeneity was corrected by the emergence of other occupational categories that assisted in the functioning of the farm. Over time, the village was inhabited by people not directly involved in agriculture, but had a great influence on shaping the intellectual potential of the countryside in the form of teachers, people of culture or administration, which fostered the diversity of the environment.

The analysis of the rural population over a longer period of time shows that in Poland the number of inhabitants between 1950 and 2015 is almost the same, an average of about 15 million people. On the other hand, the share of the rural population in Poland in the total population of the country has steadily declined, from the original 63.1% to about 40% (*Table 1*).

According to statistics, in Romania, almost 44% of the population lives in rural areas. As it can see in table 1 in Romania the situation is a little different, rural population is in a continuous decreasing. About the share of rural population we can mention that it can observe after a decreasing between 1950 and 1980 it is almost constatnt in last 30 years.

According to data from the National Institute of Statistics from Romania, in rural areas at January 1, 2015, the 2861 communes are domicile for 9.71 million people. The average size of municipalities in terms of the number of people residing in the locality was 3393 people. Compared to the average, extremes are found in Floreşti (Cluj County) with 24941 inhabitants and Bătrâna (Hunedoara County) with 131 inhabitants. The main factors that determines the decreasing of rural population are: labor migration, low birth rate, aging population. Migration is a common phenomena among young people, especially women, who due to lack of employment choose to go abroad or to urban areas. Declining birth rate is determined by the economic situation, but also the attitude of the couple to marriage, family and child birth. (Populația României pe localități la 1 ianuarie 2015)

Table 1. Rural population

Year	POLAND			ROMANIA		
	Rural population [mln]	% of total population	Absolute increment with variable basis [mln]	Rural population [mln]	% of total population	Absolute increment with variable basis [mln]
1950	15.79	63.1	-	12,15[1]	76.6	-
1955	15.48	56.2	-0.31	12,02[2]	68.7	-0.13
1960	15.39	51.7	-0.09	12.94	67.88	0.92
1970	15,57	47.7	0.18	12.78	63.14	-0.16
1980	14.75	41.3	-0.82	12.02	54.18	-0.76
1990	14.56	38.2	-0.19	10.85	46.78	-1.17
1995	14.27	38.1	-0.29	10.24	45.10	-0.61
2000	14.58	38.1	0.31	10.19	45.40	-0.05
2004	14.70	38.5	0.12	9.88	46.10	-0.31
2007	14.80	38.83	0.10	9.42	45.10	-0.46
2008	14.85	38.93	0.05	9.45	45.90	0.03
2009	14.89	39.01	0.04	9.39	46.10	-0.06
2010	15.11	39.23	0.22	9.32	46.10	-0.07
2011	15.15	39.32	0.04	9.26	46.00	-0.08
2012	15.20	39.44	0.05	9.23	46.00	-0.03
2013	15.24	39.58	0.04	9.21	46.10	-0.02
2014	15.26	39.66	0.02	9.72	43,5	0.51
2015	15.27	39.73	0.01	9.71	43.6	-0.02

Source: data Statistical Yearbooks of Central Statistical Office, https://bdl.stat.gov.pl/BDL/dane/podgrup/tablica, Baza de date Tempo-Online, INS, Bucureşti, 2017, Mateoc-Sîrb, N., 2012; [1] year 1948, [2] year 1956

The continuation of a similar state of the rural population does not mean that there were no significant changes within the group. Several generations have been exchanged, with the new generation of farmers having better characteristics than the one leaving (WAWRZYNIAK, 2004).

By analyzing the village population by sex and age, it is noteworthy that the relative balance between men and women is maintained in relation to the whole population. On the other hand, when analyzing this phenomenon in the age group of individual groups, there was a rapid collapse of these proportions among the elderly. The number of women aged 65 and over is twice as high as that of men (AGRICULTURAL STATISTICS, 2005).

Researchers on this issue wonder what the correct proportions should be for each age group in order to maintain adequate generational rotation and to ensure that the descendants of the production sphere are guaranteed a generation of successors who are ready to serve as young hosts. If we take into account the whole population for 100, children and adolescents (0-17 years) account for about 23%, people of working age (18-64) 62.0%, and people of retirement age (65 and over) Make up 13.5%. As a result of the demographic process, there is a significant decrease in the population of children and adolescents, which in recent years has been around 30%. Reducing the fertility of rural families can jeopardize the correct rotation of generations, unless the other parameters of the farm change in size and concentration of the soil, thereby contributing to the emergence of a new agrarian structure (BASIC INFORMATION, 2015) (*Table 2*).

Table 2. Rural population by gender and age group, 2015

Age group	POLAND				ROMANIA			
	Male		Female		Male		Female	
	No	%	No	%	No	%	No	%
0-2	236 152	3.10	223 091	2.91	143092	2.94	135630	2.79
3-6	353 789	4.65	335 820	4.39	210493	4.32	199998	4.12
7-12	523 613	6.88	496 752	6.49	339391	6.97	320902	6.62
13-15	261 960	3.44	248 938	3.25	186665	3.83	176314	3.63
16-19	380 167	4.99	355 526	4.64	246217	5.05	232622	4.80
20-24	575 957	7.57	549 312	7.17	327319	6.72	300681	6.20
25-34	1 232 363	16.19	1 146 151	14.97	730469	15.00	647190	13.35
35-44	1 167 716	15.34	1 100 262	14.37	825770	16.96	723920	14.93
45-54	1 018 711	13.38	943 290	12.32	652602	13.40	539526	11.13
55-64	1 016 529	13.35	972 602	12.70	520862	10.70	542094	11.18
65 and over	846 335	11.12	1 285 774	16.79	683683	14.04	1027032	21.19
Total	7 613 292	100.00	7 657 518	100.00	4866563	100.00	4845909	100.00

Source: Statistical Yearbook of Agriculture and Rural Areas, Central Statistical Office, Warsaw 2016

The demographic process illustrates the natural biological and social phenomena between the emergence of new life and the genetic depletion of the possibility of its further existence. In 2014, 151.2 thousand were born in the countryside. Children, while the birth rate was 10.3% (in the city 8.5%). For at least 10 years, the level of reproduction does not guarantee a simple substitution of generations. The decline in the number of births indicates that the village is increasingly adopting the 2 + 1 or 2 + 2 family urban model. The number of marriages is still the most affected because the vast majority of children are born in families formed by legally incorporated (BASIC INFORMATION, 2015).

In Romania, the population aged between 40 and 44 years have a share of 8%, the young population (0-14 years) are 1,583.8 thousand people (66.1%) and the elderly (65 years and over) holds 17.6% of the total rural population.

A positive phenomenon observed for several years is the steady increase in the number of persons with post-primary education. Between 1996 and 2002, the proportion of people with post-primary education increased from 51.5% in 1996 to 59.7% in 2002 (8.2 percentage points). The number of people with primary school education and no schooling was significantly reduced from 48.5% to 39.9%. At the same time, there was an almost double increase in the number of people with higher education. (WAWRZYNIAK AND WOJTASIK, 2004).

An ever-smaller gap in the acquisition of education divides the inhabitants of rural and urban areas. Although urban populations have a significantly higher percentage of people with post-primary education (in 2014-73%), rural populations are rapidly increasing their education. At the same time, more than twice the percentage of people without school education decreased in rural areas.

In the countryside, however, the older generation, and especially women who live longer, has only primary and secondary education. This phenomenon tends to decrease due to the natural biological process associated with leaving the elderly.

Education is the education category that exerts an impact on social mobility, migration processes, and trends in job change. An educated person is not permanently assigned to the ground, because he has another alternative; he can focus on non-agricultural but often in his own environment and perform social roles that require more knowledge of the world.

CONCLUSIONS

Demographic processes in rural areas allow for the analysis of completely new phenomena occurring in these areas. The village differs in many important details from the city, but as a result of the interpenetration of the value system between these populations, we tend to unify certain phenomena. This concerns in particular taking care of the educational opportunity of children and young people, seeking a new career path, creating new patterns of marriages, family reunion or expanding family standards, both in the material and in the material sphere.

The analysis shows that there are too many people in the countryside in relation to the area of the agricultural land and the number of farms. We can even talk about relative agrarian overpopulation, which results in waste of human capital and lower productivity and lower incomes.

The village is rapidly recovering its civilizational and educational backlog. Aspiring for new trends in the world as a result of globalization is not just a feature of urban environments. At the same time, the village welcomes the traditional values of family, religion, opinion and behavior in the rural environment.

The properties of a farm result in the fact that a successor, a mature, but matured person, is next to the owner of the holding. The length of life causes the generation rotation to be impeded, while the bad agrarian structure does not allow the division of farms. Hence, the introduction of structural pensions can have a positive impact on these phenomena.

REFERENCES

BRAD I., IANCU T., TOADER COSMINA-SIMONA (2011): Aspects concerning the demographic compound of the Romanian rural area, Lucrări Științifice – vol. 54, Supliment/2011, seria Agronomie, p. 94-99

MATEICA, C.S. (2010): Managementul dezvoltării rurale durabile în zona colinară a judetului Timis, Teza de doctorat

MATEOC-SÎRB, N. (2002): Dezvoltare rurală și regional în Romania, Ed. Agroprint, Timișoara

WAWRZYNIAK B.M. (2004): Przemiany struktury agrarnej w rolnictwie polskim, WTN, Włocławek

WAWRZYNIAK B.M., WOJTASIK B. (2004a): Tendencje zmian poziomu wykształcenia ludności rolniczej, Zagadnienia Doradztwa Rolniczego, nr 4

WAWRZYNIAK B.M., WOJTASIK B. (2004b): Zmiany wykształcenia mieszkańców wsi w latach 1996-2002, ACTA Oeconomia, nr 3

WAWRZYNIAK B.M., WOJTASIK B. (2005): Ubezpieczenia społeczne rolników, WTN, Włocławek

*** - Agricultural statistics, 2005

*** - Basic Information, 2015

*** - Baza de date Tempo-Online, INS, Bucureşti, 2017

*** - Local data bank https://bdl.stat.gov.pl/BDL/dane/podgrup/wymiary

*** - Podstawowe informacje o rozwoju demograficznym Polski do 2014r, 2015, GUS, Warszawa

*** - Rocznik statystyczny rolnictwa i obszarów wiejskich, 2015. GUS, Warszawa

*** - Statistical Yearbook of Agriculture and Rural Areas, Central Statistical Office, Warsaw 2016

*** - Ustawa o rentach strukturalnych w rolnictwie z 2001r z późniejszymi zmianami [Dz. U. nr 52, poz. 539]
*** - Ustawa o samorządzie gminnym z 1990r, [Dz. U. nr 32, poz. 324]
*** - Populația României pe localități la 1 ianuarie 2015, INS Romania (www.insse.ro/cms/files/publicatii/pliante%20statistice/Populatia%20Romaniei%20pe%20localitati%20la%201%20ian%202015.pdf)

Review on Agriculture and Rural Development 2017 vol. 6 (1-2) ISSN 2063-4803

EVALUATION OF RURAL TOURISM IN THE DISTRICT OF BERETTYÓÚJFALU

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ABSTRACT
Tourism and – in the countryside – rural tourism can fulfill an essential role in the economy and in rural development. The strengthening and diversification of the economic base of the countryside cannot be viewed as sufficient on its own; there can be a need for the development of the activities which use local means with the diversification and variegation of those activities. The implementation of diversification, production, processing, and marketing of folk-like goods, linking agriculture to tourism can contribute to the economy and to the increase of the region-carrying power of the given population. In our study, we examined the tourism of the district of Berettyóújfalu. We found out that the possibilities for tourism in the district of Berettyóújfalu are less known and the seasonal fluctuation connecting to programs means a particular problem. Helping the information flow, organizing and popularization of traditional and rural-like programs, tasting of local foods and creating program packages can result in a more balanced season and can provide a more reliable source of income for the hosts of the rural district.

Keywords: rural tourism, rural development, district of Berettyóújfalu, rural accomodation

INTRODUCTION

Nowadays, tourism has a defining role for countries and nations because it is one of the key sectors of the economy. In regions with favorable conditions, tourism can provide sustainment and livelihood; it has an effect on the social, cultural and economic life and to the international relations as well. For society, it means an escape from the world of work; hence they can spend their earned money on travelling, resting and relaxation. "If it is developed sufficiently, it can be the motor of the economic and cultural rise of whole countries, if not; it can destroy the natural environment and can transform value into product (PUCZKÓ AND RÁTZ, 2002).
The rural-, agro-, agri and farm-tourism terms are usually referred to by professionals as synonym words. Since this area of tourism is connected to agrarian economy, hosts provides accommodation, food, local specialties, outdoor activities and knowledge about the area's sights, using the aptness of the local environment (KOVÁCS, 2003).
Rural tourism completes the income from agriculture in a classic sense, however, between Hungarian relations; the two actions are rarely connected. It is not only about villages but it can work in small rural cities which do not belong to the part of spa and recreational districts (SZABÓ ET AL., 2009). In our research we aimed to measure the environmental, cultural and economic potential of the district of Berettyóújfalu to the rural tourism and we decided to examine the state of the district's rural tourism and the possibilities to its development.

Conceptual demarcation of rural tourism

The European perception and interpretation is very diverse, there is no unified definition or practice in connection to rural tourism.

According to the current demarcation, rustic restaurant activities are not typical to the spa and recreational districts, just like earlier, before 2009. The latest legislation concerning rural accommodations (239/2009. (X. 20.). Government regulation about the detailed conditions of operating an accommodation and about the order of the distribution of the accommodation-operating license) however, – compared to the previous action – restricts the scope of settlements which are suitable for rural accommodation, that this action can happen in places with less than 5000 capitals and where the population density is less than 100 people / km^2, shrivel those settlements from the demarcation which environment or tradition would be suitable for the requirements of rural hospitality.

The activity consists of the provision of three services: accommodation, meal and programs; from the guest's side it meals a cheap and active relaxation, during which he can get to know the specific landscape's traditions, can be the part of the local, rural-like work, e.g. weaving, basketry, harvesting, pig-killing or even can get familiar with the typical local tastes. It is really successful if the activity connects to agriculture, complete the income from that and in that way it can make the programs more colorful. At the same time, it also helps the diversification of the management (DÁVID ET AL., 2003).

MATERIAL AND METHOD

The district of Berettyóújfalu is located in the region of the Northern Great Plain and it is on the south-east part of Hajdu-Bihar County. Its location can be viewed as disadvantageous because of the eastern "poverty" and the distance from the capital city. Three city (Berettyóújfalu, Biharkeresztes, Komádi) and 22 township (Ártánd, Bakonszeg, Bedő, Berekböszörmény, Bojt, Csökmő, Darvas, Furta, Gáborján, Hencida, Körösszakál, Körösszegapáti, Magyarhomorog, Mezőpeterd, Mezősas, Nagykereki, Szentpéterszeg, Told, Újiráz, Váncsod, Vekerd, Zsáka) belongs to it.

Due to its geographical location, the district's transport is mainly characterized by the Berettyóújfalu - Biharkeresztes spatial line (No. 42, E60 highway) which is part of the Budapest-Nagyvárad national spatial line and the Central-European international transport corridor. The center of the district is the south-north direction with a regional significance, located on the Nyíregyháza-Debrecen-Békéscsaba-Szeged route (OROSZ and TÓTH, 2014).

For the exploration of the tourism of the district of Beretyóújfalu we made a research among the hosts of the rural district. The reasons of the choice besides this district is its essentially rural-like nature and also its disadvantageous situation; in that way rural tourism as a rural developing tool can have a crucial role in the strengthening of the district's ability of population retention. 17 rural hosts got into the research about the operation of rural tourism; they give 76% of the rural hosts of the examined district. The questionnaire contained 30 questions: after the general questions the characteristics of the accommodation, the economic details of the service, the characteristics of the agricultural activity and the changes and actualities about the rural tourism were presented. During the research, besides getting to know the operation we could also focus on how the activity is connected to agricultural activities and if the hosts are willing to deal with organic farming. We conducted the survey in July and August of 2014, personally, hence our aim was to receive a more detailed view of the district's rural tourism and also to receive information at from the first hand about the operation of the rural hosts. We evaluated the results with the help of Microsoft Excel program.

RESULTS

Presentation of the area under investigation

Berettyóújfalu and its surroundings are the deepest part of the Plains, a small region with an above sea-height between 87 and 140 m (I1). Its climate is moderately warm and dry. The weather is very extreme; the rain is tight and extreme in the district. The most important natural value of the district is its thermal water. The district of Berettyóújfalu' Bihar Plan's Landscape Protection Area is between two tourist landscapes. From the north, the Hortobágy National park and from the south the Körös-Maros National Park straddles is. This area provides a perfect opportunity to the introduction of gentle tourism especially in the area of rural and horse tourism. The Landscape Protection area is approximately 20000 acre big which has a significant bustard population and a buffalo reservation.

The area of the district is 1073,90 km^2. The constant population of the district shows a decreasing tendency in the last 34 years, while in 1980, 55128 people lived in the district, in 2015 44779 did. The district has a rare density, the general population density is 41,6 person/ km^2. Wandering since centuries and the decreasing of the population because of the negative sign of the natural reproduction is typical to the district's villages. As for the district's categorization based on the district's constant population, 18% of the population is under 18, 59% is between 18 and 59 and 23% is above 60. The decreasing of the number of births and the growth of deaths along with the wandering of the youth contributes to the ageing process. 31 nursery schools operate in the district and the educating and teaching of primary school-aged kids happen in 29 schools. In Hajdu-Bihar region only Berettyóújfalu has a hospital besides Debrecen, which provides specialist service to those who live here. Besides Berettyóújfalu, Biharkeresztes and Komádi also have outpatient services. Based on the description, the human-infrastructural services are considered good. The district's population's typical nature is that only here lives a considerable amount of nationality, Rumanians, who still keeps their cultural and partly lingual traditions.

The entrepreneur activity is low; the number of unemployment is high in the district. In 2015, the number of unemployed was 2477; the rate of unemployment is half as much again as the national average. The main reason behind the formation of unemployment was the decreased number of big employing companies, in that way the population is trying to earn money as micro - or small entrepreneurs, agricultural entrepreneurs, family entrepreneurs or manufacturers, in many cases as forced entrepreneurs. Growing plants and keeping domestic animals can mean a form of income. The status of accommodations is varying, but the renovation of residential areas is necessary. The automobile substance run-down, the state of public utilities is acceptable however the infrastructure, the improvement of railways and public roads could contribute to the upswing of tourism.

Results of the questionnaire research

Rural tourism is typical on the district's bigger settlements: in Berettyóújfalu, Biharkeresztes, Mezőpeterd and in Komádi, because of this, we did our research on these places.

General characteristics

70% of the asked hosts belong to the age group between 41 and 60, in a smaller rate (15%) of them are above 60 and are pensioners. We are mostly talking about a complementary way of income, hence 43% of the hosts work in the supplier sector, 22% in agriculture, and only 14% works specifically as rural hosts. Most of the hosts are dealing with rural tourism since 6-10 years, one quarter of them since more than 10 years. According to the interviews; it was hard to start in the beginning phase, since this area was unknown for

them however within a few years they managed to successfully build partnerships. Most of the answerers said that approximately 3 years is necessary for the activity to start sufficiently and to have constant guests and as a result the activity can provide income in the 4th year.

As for qualification, it can be noticed that more than 80% of the involved done some kind of course connected to rural hospitality. The other hosts feel that they have those skills which are required for the guest's precise and hospitable accommodation without any qualifications. Only one-third of the hosts are in connection with the National Rural and Agricultural Tourism Association and with the local Touristic Destination Management Association, which can help them in qualification and in the marketing work.

When discovering the reasons behind the beginning of rural tourism, 50% of the asked hosts always wanted to have this activity as their job. The opportunities were given, they had empty rooms and they did not had a well-paying job, which all paired to the before mentioned, so as a complementary way of income, they started this business.

Characteristics of the accommodation

Moving on to the characteristics of the accommodations, 60% of them has no certification, because they did not meet the requirements, moreover, the costs keep them away from the start of the process. 24% of the accommodations have a 4 sunflower qualification; the others have a 2 or 3 sunflower one. Besides the status of the accommodation, the number of rooms and spaces is also important. There is no hosting place with less than 5 spaces in the district. In 25% of the accommodations 6-10 spaces can be found and in three-quarter of them the number of spaces is between 11 and 16. Accommodations with more spaces has a much significant amount of guests than those with less spaces, however the chance of not using up their capacity is lower. There are hosts, whose contacts and returning guests reach a constantly growing number thanks to the yearly improvements. The average staying time of guests is 2 days, however, some of them have the opportunity to spend more days in this environment, it can be a long weekend or even a whole week.

The price of the accommodation without meals, tourist tax and VAT is between 2000-6000 HUF/person/night. The price is in a strong connection with the equipment of the room and the garden and also with the quality certification of the accommodation. The rate of those hosts who offer meals is outstanding (80%). Some of them have smaller restaurants but most of the places have a dining room or kitchen. Accommodations with less space usually do not offer meal, in this way they do not provide guests chance to get to know the local, rural-like meals. In this case, if the guests request it, they provide meals with the help of local restaurants.38% of the hosts organize programs, so these 5 accommodations where the 3 service from the demarcation of the rural tourism – accommodation, meals, programs – are present at the same time on the service palette. The environment's rural character and even keeping domestic animals in a separated place next to the accommodation are significant on these places. They organize special programs for kids, just as animal petting, horse riding, driving around the area and also crafting activities. Pig-killing is also a program connected to animal keeping. It is especially liked amongst guests because of the atmosphere of the oven and the tasting of the food made in them. Hosts provide sport programs for the guests as well; horse riding, archery and fishing are the mostly liked from the programs. One of the accommodations provides massage, solarium, sauna and Jacuzzi as extra services, however these, besides providing comfort to guests, do not fulfill the tradition keeping functions of the district. With similar services and medicinal water, the spa of Berettyóújfalu waits for the guests.

Economic characteristics of the activity

We researched that what kind of application support hosts pressed in to service in connection with rural tourism. Little more than half of the asked did not pressed support into service because of the strict regulations and the connecting obligations. The lack of information also contributes, since for the pensioner hosts it is difficult to be informed from the supports advertised on the internet. Since most of the hosts are not members of the organizations dealing with rural tourism, they cannot receive information from the actual possibilities through them. Those who applied for a support applied especially for supports of the European Union and only in a smaller part for governmental ones. We estimated what changes they made in correspondence with the activity. Most of the answerers transformed the house, modernized it, made a fruit and vegetable garden and did renovations and expansions connecting to animal keeping. There are hosts who expanded the accommodation with bathroom, moreover tried to elongate the season with the developing of heating systems.

Investments in connection with the broadening of the services help in the preservation of the rural-likeness – which is important in rural tourism – which can reach the guest of the cities. To the question of how much money can hosts earn yearly from rural tourism, many of them did not answered, most of the answerers marked loss or stagnancy. For hosts who have less spaces, the yearly realized income can be up to 1.5 million HUF. Bigger hosts can reach 3 or even 5 million HUF incomes yearly. Along this rate it is worth mentioning that many rural hosts cannot separate the costs and expenses appearing during the activity from the costs and expenses of housekeeping, so they have no exact information of how much income they can reach in a year.

Agricultural connection

During our research we also mentioned how rural tourism works in a classical sense, so if the activity connects to the agricultural activity and if yes, how and in what measure. Most of the hosts deal with backyard agriculture, only a few hosts do larger volume of crops. Organic farming is not typical in backyard plant-growing; essentially there are no interests in it among the guests. Goods produced during farming are used for the Hungarian specialties made for guests and the use of fruit firewater and honey is also typical in hospitality. One or two hosts deal with keeping horses and pigs in which case they can offer horse riding and pig-killing as programs for the guests. Pig-killing, sausage making, sheep shearing, harvesting and sometimes food processing are also among the popular programs during rural hosting. For kids, animal feeding, pet care moreover smaller works in the kitchen garden could cause happiness. These services can only be found at the 1/3 of the accommodations.

Current issues

At the end of our research we tried to get answers to the effect of the economic crisis, to the reasons behind the change of tourist traffic, open up the services of the rural guest table and the importance of the rural-like goods in the district's rural tourism. More than two-third of the hosts experienced a decrease in the number of arriving guests and the nights spent in their accommodations because of this they could not improve further. During the economic crisis, three more accommodations opened from which one shows an increasing tendency in both the growing of the number of guests and in income. In case of the other two accommodations, 20-30% decrease could be sensed in the number of guests. The one accommodation with bigger number of decrease closed, the one with the smaller degree closed with a smaller amount of loss. At the other hosts, a smaller amount of decrease in income can be noticed. Stagnation and increase were in those places, where they could

provide something new to the guests, every year. The increased number of guests is mostly the result of the bigger expansion processes, moreover that a positive picture formed about the given accommodation and from the host and the satisfied guests not only come back but also spend more days in the place then before and they bring more guests with themselves as well. The number of guests increased with 10-15% on these places.
This recession is the result of the Hungarian economic situation, however, in a national level, the economic crisis was beneficial for rural tourism; this, cannot be seen in the examined district. People have less money, they cannot use thermal water in an appropriate measure and the reputation and marketing of the spa is far from the spa of Hajdúszoboszló. The organization and advertising of festivals is less effective, at many times, events are only last for one day, so visitors do not use accommodations. Rural guest table is one of the most relevant services of rural tourism, however this can only be found at one-third of the hosts because of the lower need. Hosts provide rural-like goods, foods typical to the district. Besides Hungarian specialties, hosts provide oven-roasted meats, breads, bread scones and cakes for guests. As a local food they offer a special version of the Hajdú-Bihar stuffed cabbage and the sausage-pasta soup and grated noodles.

CONCLUSIONS AND RECOMMENDATIONS

The touristic opportunities of the district of Berettyóújfalu are less known, since Hajdúszoboszló can be found next to it and it attracts more people because of its accessibility. Improvement of infrastructure could help a lot in the accessibility of the district of Berettyóújfalu. M4 and M35 highways would make the transportation between bigger distances easier in the western and eastern direction. If the expressway would be built between Debrecen and Nagyvárad, both of the big cities would be accessible faster.
For the district's rural hosts' more organized operation it would be necessary for every host to have contacts with one of the organizations dealing with rural tourism with which the hosts' protect of interest, regular information, organized hospitability and certification of the accommodation would be possible. With finishing of a specialized tourism course and along with this, with the expansion of the gastronomical and program offers the importance of the preservation and introduction of the rural lifestyle would be noticed. The vast majority of the asked accommodations are without certification, only two of the hosts plans to improve the comfort level and entering the sunflower certification system. The certification of accommodation in a long run is one criterion of a quality hospitability which is advised to the other hosts as well. Rural tourism is starting to connect with the agricultural activities done at home which helps the formation of the classical form of accommodation. The co-existence of meals and programs is still bare, although rural tourism is only complete with accommodation, meals and programs which would be helped by the serving of agricultural products and the guests involving into traditional, agricultural work. The rural guest table service could motivate small producers and rural hosts dealing with agriculture to produce agricultural goods with traditional methods typical to their district which they can sell directly to their guests. Based on the local specialties, the contemporary, traditional agricultural methods, contemporary trades can be reproduced, which are presented during local or cross-town programs for the visiting guests. All of these force citizens to cooperate, helps the formation of their identity during which they can rediscover the values of their district. Seasonal fluctuation means the problem for hosts. The biggest traffic is in the month at the end of spring and in summer since this few months are the most ideal for hosting guests from an environmental point of view. The most relevant programs of the district are organized at this time which waits for

the guests with a variety of programs in every year. The lack of information about the events can be a blocker of the growing of the guest's number so a special attention should be paid to the development of information flow so more and more people could get information about the opportunities and programs. During some events, the number of guests decreased hence they could provide less programs to visitors. Hosts with displaying their own flyers in local-, regional- and national publications and with creating separate flyers for their internal and foreign guests can solve this problem.

With the multi-day events, putting traditions to the first place and with the tasting of local foods and the introduction of Hungarian specialties, the appeal of the district could be increased. It would be expedient to organize constant programs and events with a tradition-keeping nature. With organizing family celebrations, such as weddings, birthdays, name days, wedding anniversaries or balls the number of guest night could be increased. Besides medical tourism, the capability of natural resources could be used in a greater volume, for example by visiting the Csere Forest or the Bihar Arboretum within the frame of a tourist program or by visiting the rich animal population, for example the bustard and buffalo reservation.We advise the formation of tourist program packages, which assumes the co-operation of the district's touristic members, small and medium entrepreneurs and farmers, moreover the co-operation between private accommodations could help in the strengthening of the activity if they start to promote each other's services to their guests. An example for these program packages are the following: craft and creating camps (leather working - weaving- embroidery-, wood carving-, hurdling-, straw-bottoming-glazing-, pottery- and whip making, fishing, hunting, forest school.

In this way, rural tourism can have a great role in the preservation of the district's folk traditions and customs and in the maintenance of the rural lifestyle. The fact that the rural lifestyle and knowledge which went from father to son, mother to daughter is a huge treasure to the next generation and the district's citizens and especially the older generation should be aware of that; and it's preservation and passing onto the youth is one of our relevant tasks.

REFERENCES

DÁVID L., BUJDOSÓ Z., PATKÓS CS. (2003): A turizmus hatásai és jelentősége a területfejlesztésben, In: A terület és településfejlesztés alapjai, szerk. Süli-Zakar I., egyetemi tankönyv, Dialóg Campus Tankönyvek, Budapest-Pécs, pp. 433-453. ISBN 963 9310 70 0

KOVÁCS D. (2003): Falusi vendéglátás Magyarországon. Agroinform Kiadóház, Budapest, 119. p. (ISBN: 963 336 680 1)

Debreceni Egyetem, Gazdaságtudományi Kar, Vidékfejlesztés, Turizmus és Sportmenedzsment Intézet. Debrecen, 2014. 24.p.

PUCZKÓ L., RÁTZ T. (2002): A turizmus hatásai. Aula Kiadó, Budapest, 15 p., 23-26. p. (ISBN:963 9345 89 x)

SZABÓ B., KÖNYVES E., TIKÁSZ I. E. (2009): A falusi turizmus helyzete és gazdasági kérdései. Szerk. Szabó B. MTA Társadalomkutató Központ, Budapest, 14-33. p., 63-64. p., (ISBN: 978 963 508 567 5)

SZABÓ B. (2010): A falusi turizmus helyzete, gazdasági értékelése és vizsgálata a mezőgazdaság diverzifikációs lehetőségeként. Habilitációs értekezés. Debreceni Egyetem, Agrár- és Gazdálkodástudományok Centruma, Gazdálkodástudományi és Vidékfejlesztési Kar, Debrecen, 2010. 1.p.

I1: A Berettyóújfalui kistérség környezeti állapota

http://www.date.hu/acta-agraria/2005-16/tikasz.pdf letöltés dátuma: 2014. március 13.
239/2009. (X. 20.) KORMÁNYRENDELET a szálláshely-szolgáltatási tevékenység folytatásának részletes feltételeiről és a szálláshely-üzemeltetési engedély kiadásának rendjéről. Magyar Közlöny 2009 évi 148. szám, 38500-38509.

Review on Agriculture and Rural Development 2017 vol. 6 (1-2) ISSN 2063-4803

COMPARATIVE ANALYSIS OF BODY WEIGHT AND CONDITION IN TWO BROWN HARE POPULATIONS

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ABSTRACT
The condition of the populations are useful parameters for the reasonable game management. In this study the physical condition of Brown hare stocks (Lepus europaeus, Pallas 1785) was analyzed, measured body weight (BW) and determined kidney fat index (KFI). These methods were applied during our survey in the hunting period of 2014/15 and 2015/16. In total 272 (123 male and 149 female) samples were collected from two hunting areas in Great Plain (from County Békés and Jász-Nagykun Szolnok). The aim of our work was to collect data concerning the conditions of the populations. All hares was sexed and classified in 2 age groups (young <1years), and (old> 1years). The age was established by Stroh-mark in the hunting field and by dried eye lenses in the laboratory. BW and the weight of the kidney and perirenal fat was measured and the data were statistically analysed (group statistics, Levene's test for Equality of Variances and, t-tests for Equality of Means). As a result of our examination the range of KFI was 1.25-5.14. The weight of perirenal fat was between 2-34gramm.KFI was greater in females than males. The average BW of the hares in every age groups were less than it is according to literature dates, however the conditions of the hares were good and in very good in both hunting areas. The BW and the amount of the perirenal fat in adult female hares were the greatest.

Keywords: Brown hare, kidney fat index, KFI, condition, BW, age structure, Hungarian Great Plain

INTRODUCTION

For the sustainable game management is essential to be aware of basic biological parameters of certain game population. The body condition can be an indicator of population dynamics, because it relates to birth and to death data (FARAGÓ AND NÁHLIK, 1997) too. There are several various practical methods for estimating condition such as BW measurement, bone marrow fat content and the size of thymus (SUGÁR, 1983). Thymus measurement is a suitable method for the condition estimation in young animals. The BW of hares give us valuable data series for estimating body conditions by sex and by age groups. On the basis of the assessment SZEDERJEI (1959) cit. FARAGÓ (2002) the average BW of Brown hare in Hungary is 3.81 kg (n=163123). In the results of SZÉKY (1973) the average body mass by male hares was 3.78 kg (n=1266) and by female hares 3.82 kg (n=1629). The color and the consistency of bone marrow are approximate. The proportion of the wet and dry weight of bone marrow give us more accurate information for estimating physical condition of animals (VERME AND HOLLAND, 1973). This method is particularly convenient for condition survey by dead animals. FRANZMANN AND LERESCHE (1978) estimate the condition by the value of blood hematocrit. The results of blood test can also be significantly influenced by the season, by the age of animals, by the level of hormone and by possible pregnancy. Derived data have great imtortance by estimating condition of animals such us KFI.

The value of KFI qualified in the case of big game:1-1.5 weak, 1.5-2 average and over 2 good (SUGÁR, 1983). STOTT AND HARRIS (2006) used always left kidneys and left perirenal fat in their examinations, because it was found to be reliable. FERNANDEZ ET AL. (2010) established the physical statement of animal from the hundredfold value of the proportion of freshly removed perirenal fat and kidney weight. The condition of hares change according to the nutrition supply and reproductive time. By fertile females the condition is in breeding time the best during the year (HANKS, 1981). Fat reserves arise the most intensively in the abdomen by lactating female hares which cover breastfeeding STOTT AND HARRIS (2006). There are relationship between the number of embryos, the stage of pregnancy and the KFI change FERNANDEZ ET AL. (2010). The spermatogenesis of male hares with good physical condition began earlier and its oestrous cycle took longer (SZÉKY AND LENNER, 1973). The yearly lipid intake and fatty acid components in digestive systeme of Brown hares was examined by POPESCU ET AL. (2011). The amount of lipid intake in May was average and in November maximal. Lactating female hares prefer plants which contains much linolenic acid e.g *Glycine, Papaver, Trifolium, Panicum and Medicavo* species. FERNANDEZ ET AL. (2010) KFI value in female hares was the greatest in reproductive period. RÖDEL ET AL. (2005) obseved that European rabbit (*Oryctolagus cuniculus L., 1758)* with smaller body size began the breeding period later but the litter size didn't differ significantly. By the result of GÁL (2006) there is a relationship between the KFI and lung worm infestation (*Prorostrongylus tauricus* and *Protostrongylus pulmonaris*). It is not proven in the case of infestation by *Trichuris leporis* species.

MATERIAL AND METHOD

The aim of our examinations was to determine and to compare the body conditions of two European Brown hare populations in Hungarian Great Plain, where the species can be found in relatively high abundance. Places of origin of samples were from Túrkeve (47° 7' 9" N and 20° 49' 15.5" E) in Jász-Nagykun Szolnok county (n=86 in 2014) and (n=49 in 2015) and from Békéscsaba (46° 43' 49.5" N and 20° 56' 12" E) (n=68 in 2014) and (n=69 in 2015) in Békés county. Most parts of the two areas are under agricultural cultivation: mainly arables, meadows and pastures. The total 272 samples necessary for the research were collected from the hunting period of 2014-2015 and 2015-2016 from 1 October until 31December. Hares were weighed (BW) and their sex was determined immediately after the shot by external genital organs. Age estimation was made by the existence of the Stroh-mark and by the weight of dried eye lenses under laboratory conditions. The animals were divided into two age groups: dried eye lenses weight less than 280 mg (juvenile) and heavier than 280 mg (adult), based on (KŐHALMY, 1999). For the purpose of condition estimation we collected kidneys and renal fat (kidney fat index – KFI). The weight of kidneys and separeted perirenal fat was measured accurately grams and devided by age groups, sex and hunting areas. We analysed the data with the statistical program SPSS 22.($P < 0.05$) and Microsoft Excel. We applied-Levene's test for Equality of Variances and, t-tests for Equality of Means. We compared the conditions of Brown hares by age groups, sex and hunting areas. KFI was calculated by formula used SUGÁR (1983) for determine of body conditions of big games:

$$\text{KFI} = \frac{\text{the weight of the kidneys} + \text{the weight of the perirenal fat}}{\text{the weight of the kidneys}}$$

RESULTS

Age structure and average BW:

Hunting bag considered to be representative in our opinion (in both areas and parts of areas were more times hunting and high number of shot hares) (*Table 1*). There was significant difference between hunting areas and sexual composition of populations in samples which were collected in 2014 (Sig<0.001 Std. error 0.078). In 2015 there was no significant difference between either the sexual composition (Sig 0.825 Std. error 0.094) or the age structures (Sig 0.519 Std. error 0.094) of the two areas. The average BW of male hares was 3442 g and female ones 3433g in "Túrkeve" (*Table 1*). In 2015 by males 3534 g and by females 3791 g. In hunting area Békéscsaba the average BW of male hares was 3484g (in 2014) and 3454 g (in 2015) and by the female ones 3224 g (in 2014) 4126 g (in 2015). The average BW of juvenile male hares was 3253g (n=77), and the average BW of juvenile females 3491 g (n=79). The average BW of adult male hares was 3705 g (n=46) and by the female ones 3796 g (n=70). The variance of the BW and age groups in hunting season 2014/15 were homogeneous by Levene-test (Sig. 0.282) but on the basis of the two-sample t-test sample means are different from each other Sig. (2-tailed) <0.001 by 95% confidence level (Std.error 49.632). The variance of the BW and age groups in hunting season 2015/16 were homogeneous as well (Sig. 0,108) and sample averages are different too Sig. (2-tailed) 0,047 by 95% confidence level (Std.error 101.032).

Table 1. The average BW of the hares taking into account the sex and age structure (based on dried eye-lens)

hunting field/ year*	Male (♂)					
	Total**	J[a]	A[a]	J[b]	A[b]	Average (♂)
104/2014	29	21	8	3266	3702	3484
101/2014	42	26	16	3109	3776	3442
104/2015	31	13	18	3469	3439	3454
101/2015	21	17	4	3167	3902	3534
Average				3253	3705	3478
	Female (♀)					
	Total**	J[a]	A[a]	J[b]	A[b]	Average (♀)
104/2014	57	31	26	3036	3412	3224
101/2014	26	22	4	3151	3716	3433
104/2015	38	18	20	4164	4089	4126
101/2015	28	8	20	3614	3969	3791
Average				3491	3796	3643

Source: FARKAS (2016)

*: hunting field/ year

**:total

[a]: age group: J – juvenile; A – adult

[b]: average BW (g)

Age structure and KFI:

The average KFI of the hunting bags taking into account the sex and age structure in both hunting season showed the *table 2*. The average KFI of male hares in Túrkeve was 2.60 (in 2014) and 2.28 (in 2015) and by female ones 2.62 (in 2014) and 2.30 (in 2015). In county

Békés the average KFI of male hares was 2.57 (in 2014) and 2.22 (in 2015). By female hares 2.72 (2014) and 2.25 (2015). The average KFI was in total male hares 2.58 (in 2014) and 2.25 (in 2015). By total female hares was this index 2.67 (2014) and 2.27 (in 2015).

Table 2. The average KFI of the hares taking into account the sex and age structure (based on dried eye-lens)

hunting field/ year*	Male (♂)						
	Total**	J[a]	A[a]	J[b]	A[b]	Average (♂)	
104/2014	29	21	8	2,69	2,45	2,57	2,58
101/2014	42	26	16	2,56	2,64	2,60	
104/2015	31	13	18	2,21	2,24	2,22	2,25
101/2015	21	17	4	2,43	2,14	2,28	
	Female (♀)						
	Total**	J[a]	A[a]	J[b]	A[b]	Average (♀)	
104/2014	57	31	26	2,67	2,77	2,72	2,67
101/2014	26	22	4	2,50	2,75	2,62	
104/2015	38	18	20	2,45	2,05	2,25	2,27
101/2015	28	8	20	2,11	2,50	2,30	

Source: FARKAS (2016)
*: hunting field/ year
**:total
[a]: age group: J – juvenile; A – adult
[b]: average KFI by age groups

These index values are typical of populations in good conditions. The range of kidney weights were between 5 and 13 grams and the weight of perirenal fat were 2-34 grams. The range of KFI in total were between 1.25 and 5.14 (in 2014) and between 1.41 and 4.14 (in 2015). The variance of the KFI by hunting areas in the hunting season 2014/15 were homogeneous according to the Levene-test (Sig.: 0.565) and on the basis of two-sample t-test sample means aren't different from each other Sig. (2-tailed) 0.435 by 95% confidence level. In 2015 the variance of the KFI by hunting areas were not homogeneous by Levene-test (Sig<0.05) but on the basis of the two-sample t-test sample means aren't different from each other Sig. (2-tailed) 0.097 by 95% confidence level. The variance of the KFI by age groups in total examined was homogeneous in both hunting seasons (Sig.: 0.131) (in 2014) and (Sig.: 0.832) (in 2015). There wasn't significant difference Sig (2-tailed) 0.568 (Std error 0.77) (in 2014) and Sig (2-tailed) 0.711 (Std error 0.09) (in 2015) by 95% confidence level.

DISCUSSION

Although knowledge of condition of individuals provide useful information for proffesional hunters about their populations it must take into consideration that sick or weak animals often does not get into the sample. To knowing more accurate data about the condition we needed samples from dead hares which were found somewhere e.g roadkill. It would be suitable for the other estimating method for conditions applied together such us KFI combinated with the proportion of the wet or dry weight of bone marrow fat. In our results the average BW of jung male hares (3253 g, n=77) was less than

the average BW of jung female ones (3491 g, n=79). In the survey of PINTUR ET AL. (2006) in Croatia the average BW of jung male hares was calculated 3580 g and by jung female hares 3410 g. In our study the average BW of adult male hares 3705 g (n=46) was less than that of adult female ones (3796 g). Opposite of the results of PINTUR ET AL. (2006) in Croatia where the average BW of adult male hares were 3840 g and by the adult female ones were 3660 g (n=279). The average BW of total male hares was 3478 g (n=123) and that of the females was 3643 g (n=149) this value is less than data of SZÉKY (1973): 3780 g (♂) and 3820 g (♀). Of course the BW and KFI value depend on more factors e.g habitat quality, time of collecting samples, weather. In both hunting areas and hunting seasons the two populations were in good and excellent conditions but the average BW were less than in other authors. In both years the KFI of female hares were higher than in male ones. The average KFI of male hares in total were 2.58 (in 2014) and 2.25 (in 2015). This index by total female hares were 2.67 (in 2014) and 2.27 (in 2015).

ACKNOWLEDGEMENT

We are grateful to two hunting assocations for helping to collect samples: Kossuth Hunting Assotiation in Túrkeve and Megyer Hunting Assotiation in Békéscsaba. We would like to thank engineers of wildlife management and professional hunters for their contributions. We express our gratitude to Tivadar Kontos, Viktor Máté (Túrkeve) and Gábor Szakál (Békéscsaba) for their help.

REFERENCES

FARAGÓ, S., NÁHLIK, A., (1997): A vadállomány szabályozása. A fenntartható vadgazdálkodás populációökológiai alapjai. Mezőgazdasági Kiadó. Bp. 177-180p.

FARAGÓ, S. (2002): Vadászati állattan. Mezőgazda Kiadó. Bp. 250-259p.

FERNANDEZ, A., SORIGUER, R., CARRO, F., CASTIEN, E. (2010): Relation between physical condition and reproductive activity in a population of Iberian hares, Lepus granatensis in northern Iberian Peninsula. Folia Zool. 59(1): 1 – 8.

FRANZMANN, A.W., LERESCHE, R.E. (1978): Alaskan Moose Blood Studies with Emphasis on Condition Evaluation.Journal of Wildlife Management 42 (2): 334

GÁL, J. (2006): A Lajta-Hanság mezei nyúl állományának vizsgálata különös tekintettel annak egészségügyi helyzetére. PhD értekezés. Sopron.

KŐHALMY, T. (1999): Korbecslések. Szarvastól a siketfajdig. Nimród Vadászakadémia. 2: 85-87.

PINTUR, K. POPOVIĆ, N., ALEGRO, A. SEVERIN, K., SLAVIVA, A. KOLIĆ, E. (2006): Selected indicators of Brown hare (*Lepus europaeus* Pallas, 1778) population dynamics in northwestern Croatia. Vet. arhiv 76(Suppl.): 199-209.

POPESCU, F.D., HACKLÄNDER, K., ARNOLD, W., RUF, T. (2011): Effects of season and reproductive state on lipid intake and fatty acid composition of gastrointestinal tractcontents in the European hare. Journal of Comparative Physiology 181:681-689.

RÖDEL, H.G., BORA, A., KAETZKE, P., KHASCHEI, M., HUTZELMEYER, H.D., ZAPKA, M., VON HOLST, D. (2005): Timing of breeding and reproductive performance of female European rabbits in response to winter tempereture and body mass. Canadian Journal of Zoology 83: 935-942.

STOTT, P., HARRIS, S. (2006): Demographics of the European hare (Lepus europaeus) in the Mediterranean climate zone of Australia. Mammalian Biology 71(4): 214-226.

SUGÁR, L. (1983): A nagyvad tápláltsági állapotának mérése (a vesezsír-index). Nimród Fórum 10:10-11.
SZÉKY, P. (1973): Kutatási módszerek mezei nyúl populációk vizsgálatára. A vadgazdálkodás fejlesztése. Apróvadtenyésztés 6:5-21.
SZÉKY, P., LENNER, L. (1973): Szaporodásbiológiai vizsgálatok a mezei nyúl (Lepus europaeus) hímjeinél. A Vadgazdálkodás Fejlesztése. Apróvadtenyésztés 6:5-17.
VERME, L.J., HOLLAND, J.C. (1973): Reagent-dry assay of marrow fat in white-tailed deer. Journal of Wildlife Management 37: 103-105.

Review on Agriculture and Rural Development 2017 vol. 6 (1-2) ISSN 2063-4803

THE EFFECT OF DIFFERENT FERTILIZER TREATMENTS ON THE YIELD AND QUALITY OF WINTER WHEAT

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ABSTRACT
The effect of fertilization on the yield and quality of winter wheat was studied on meadow soil in 2015-2016 years in Hódmezővásárhely. The experiment was set up on the area of SZTE Tangazdaság Ltd, in three replications. The preceding crop was alfalfa. Four fertilizer steps were applied besides the control: N80PK30, N100PK30, N120PK0, N120PK30 kg/ha active ingredients. The year 2015-2016 was favourable for winter wheat production. The amount of precipitation in the vegetative period of winter wheat was higher by 92.8 mm than the average. We processed the obtained data by single factor variant analysis. In control treatment the yield was 5.70 t/ha. We obtained the maximum yield 7.37 t/ha in N80PK30 kg/ha fertilizer treatment. The yield difference between the two treatments was statistically justified. The nutrient doses higher than N80PK30 did not increase the yield of wheat. The examined quality parameters (gluten content, crude protein content, Zeleny number) reached the highest value in N80PK30 treatment. Our scientific results proved, that in the case of good preceding crop we can reduced the amount of fertilizer, which is important in environmentally and economical point of you.

Keywords: winter wheat, fertilization, yield, gluten content, crude protein content

INTRODUCTION

To determine the harmonious nutrient supply is crucial as it has a considerable effect not only on the volume and quality of yields and the environment but also on the effectiveness of production (SÁRVÁRI, 1984, JAKAB ET AL., 2016).
The crop-year basically determined the dry matter production, assimilation area and yield of winter wheat; these effects were modified by fertilization. The effects of genotypes were moderated (PEPÓ, 2005).
The low yield averages in winter wheat production can be due to the fall-back of chemical fertilization; this is why the use of fertilizers must be increased in order to reach higher and more consistent amounts of crop (KOMAREK 2007, 2008).
Nowadays more and more farmers use different soil bacterium preparations besides the fertilizers. These products contain different bacteria which can improve the nutrient supply of plant. With the application of these products we can reduce the amount of fertilizers, which enables the environmentally friendly and economical production. They improve the physical properties of the soil, thereby improving physical and chemical properties of the soil, and maintain the soil fertility (JAKAB ET AL., 2004, JAKAB 2006a; JAKAB 2006b; JAKAB 2010).
The yield and quality fluctuation the years can reduce the application of good variety and professional agro-technical methods (GYŐRI, 2006).
TANÁCS ET AL. (2000) studied the effect of fungicides and foliar fertilizers on the quality of winter wheat. They stated, that the variety x fungicide treatments caused significantly changes in examined quality parameters (gluten content, falling number), but the effect of foliar fertilizers was lower.
In a dry year the effect of fungicide treatments was not significant for the baking industry parameters (wet and dry gluten content, falling number (TANÁCS AND GERŐ, 2002).

TANÁCS ET AL. (1997) examined the effect of NPK fertilization on the amino acid composition of winter wheat grain yield. They established that the highest amino-acid value was in N 180 kg /ha fertilizer dosage except the ARG and HIS.
The fertilization had positive effect on the baking parameters of winter wheat. Among the macro-elements the nitrogen had the highest effect on the quality parameters of winter wheat (JOLÁNKAI ET AL., 1990; RAGASITS AND SZABÓ, 1992; TANÁCS ET AL., 1993, TANÁCS, 2005).

MATERIAL AND METHOD

The experiment was set in three replications on the area of SZTE Tangazdaság Ltd. The soil was meadow soil. The soil analysis data showed, that it had proper nitrogen, low phosphorus and very good potassium content (*Table 1*).

Table 1. Main properties of the experimental field area

pH (KCL)	P_2O_5 (mg/kg)	K_2O (mg/kg)	Humus (%)	Soil plasticity value (K_A)
7.17	336	620	3.39	48

Source: HL-LAB Ltd., 2016

The year 2015-2016 was favourable for winter wheat production. The amount of precipitation in the vegetative period of winter wheat was higher by 92.8 mm than the 50 year average (*Table 2*).

Table 2. The distribution of precipitation in the vegetative period of winter wheat in 2015-2016

Month	Rainfall (mm)	50 year average rainfall (mm)	Difference (mm)
October	88.3	34.7	53.6
November	34.3	41.1	-6.8
December	7.3	43.0	-35.7
January	48.4	30.6	17.8
February	84.2	30.1	54.1
March	21.1	29.8	-8.7
April	19.4	39.9	-20.5
May	38.8	58	-19.2
June	86.0	75.3	10.7
July	106.0	58.7	47.3
Total amount of rainfall (mm)	**533.8**	**441.0**	**92.8**

Source: SZTE Tangazdaság Ltd.

The small-scaled plough experiment was set in three replications, organised as a random block in 2015. Beside the control we applied four fertilizer treatments: N80PK30, N100PK30, N120PK0, N120PK50 kg/ha active[L1] ingredients. The[L2] preceding crop was alfalfa. Fall tillage involved deep ploughing at 30 cm depth. The variety was Lucullus. Apart from fertilization the parcels received the same agro-technology. We processed the obtained data by single factor variant analysis.

RESULTS

Without any fertilizers the yield was 5.7 t/ha. In N80PK30 treatment we reached the maximum yield amount, 7.37 t/ha, which was significantly higher compared the control. The higher fertilizer doses did not increase the yield compared the N80PK30 treatment. Alfalfa was favourable fore-crop, therefore the maximum yield was in the least (N80PK30) fertilizer treatment (*Figure 1*).

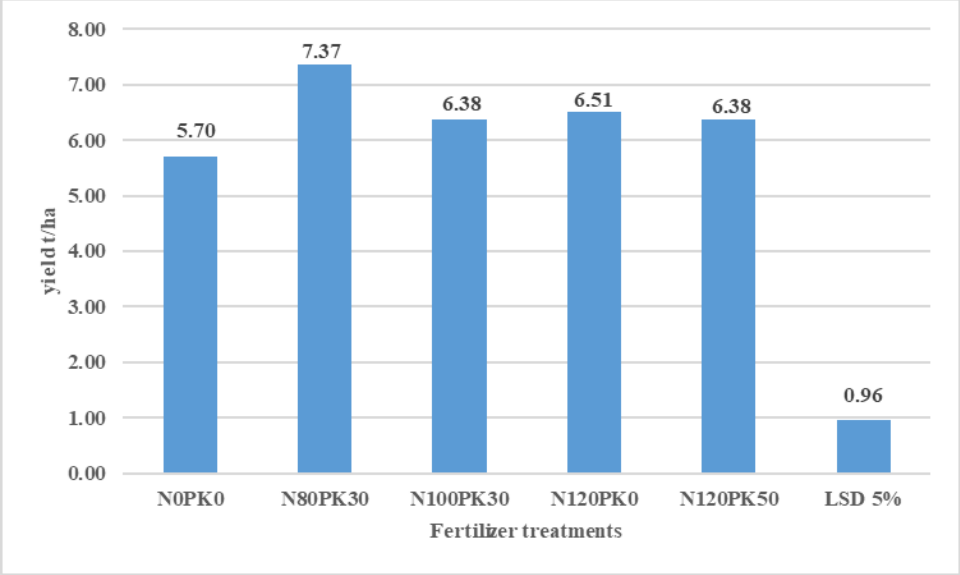

Figure 1. The effect of fertilization on the yield of winter wheat

We examined the effect of fertilization on the quality parameters (crude protein content, gluten content, Zeleny number) of winter wheat. The gluten content was 36.50% in non treated plot. In the N80PK30 treatment reached the highest value 40.60%, which was significantly higher compared the control value. In the other treatments decreased the gluten content compared to N80PK30 treatment (*Figure 2*).

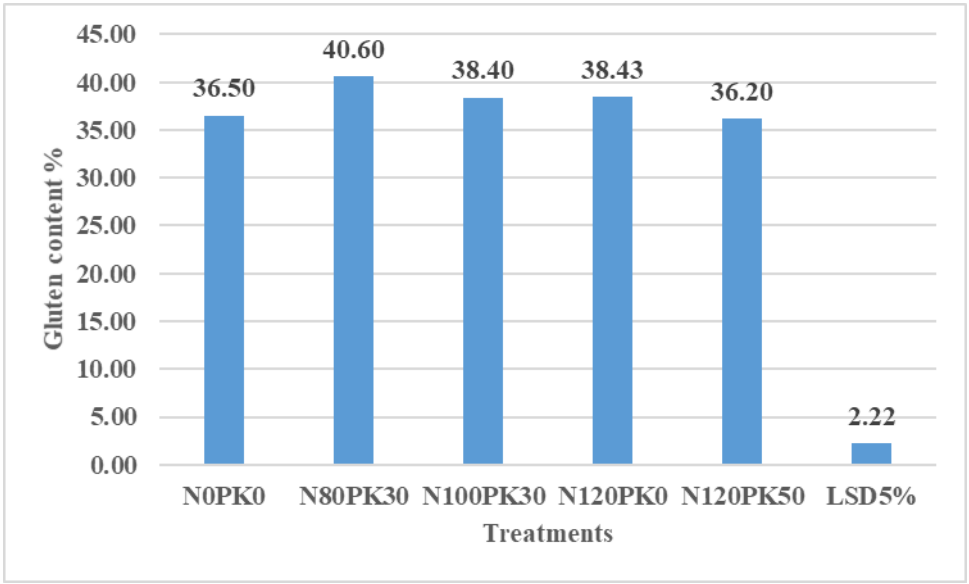

Figure 2. The effect of fertilization on the gluten content of winter wheat

We measured 15.57% crude protein content in N0PK0 treatment. The highest content of crude protein (17.30%) was in the N80PK30 treatment, which was statistically justified higher compared with the control and the other treatments (*Figure 3*).

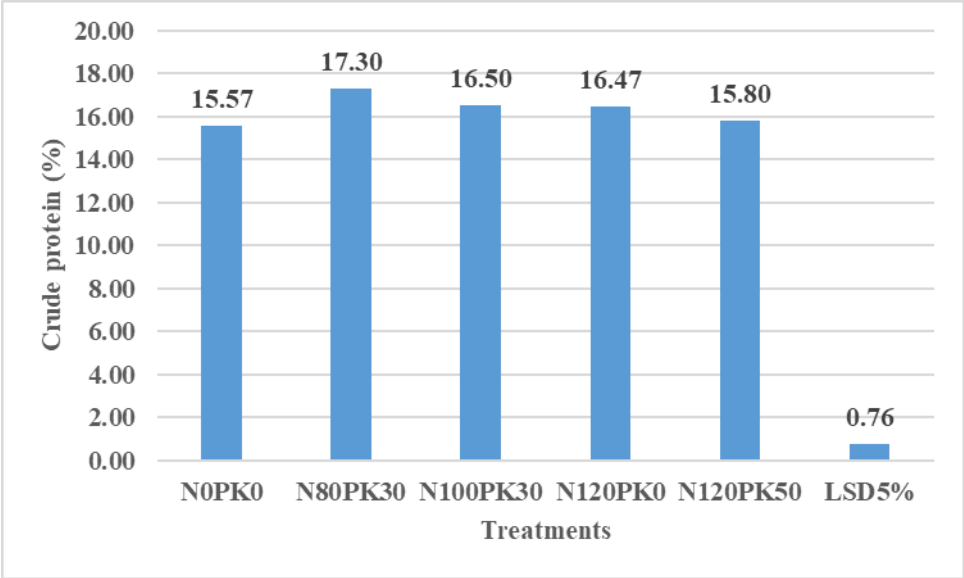

Figure 3. The effect of fertilization on the crude protein content of winter wheat

The Zeleny number was 64.1 ml in control treatment. In N80PK30 treatment it reached the maximum value, 73.07 ml. The difference was statistically justified. In N100PK30 treatment we measured significantly higher result (69.63 ml) compared the N0PK0 treatments too (*Figure 4*).

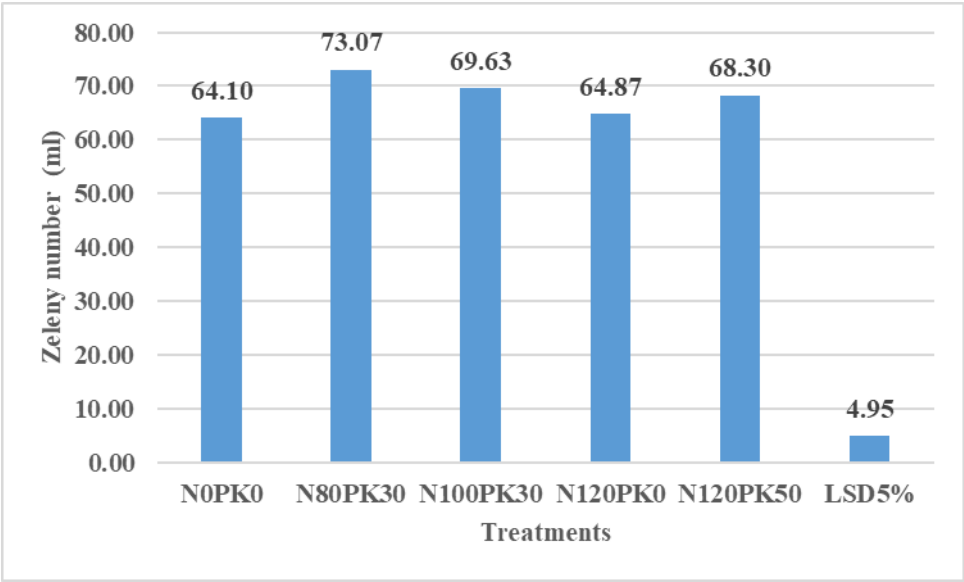

Figure 4. The effect of fertilization on the Zeleny number of winter wheat

CONCLUSIONS

Due to the favourable preceding crop (alfalfa) and the amount of precipitation in the vegetation period of winter wheat we measured the highest yield in the lowest fertilizer treatment. Nowadays the application of mineral fertilization is very important economical

and environmental protection issue. Therefore, it is of high importance to determine the optimum fertilizer amount of winter wheat. This is relevant in order to improve the efficiency of fertilizer application, just as to decrease environmental contamination. Our scientific results proved, that in the case of good preceding crop we can decrease the amount of fertilizer, which is important in environmental and economical point of view.

REFERENCES

GYŐRI Z. (2006): Ismét napirenden az őszi búza minősége. Gyakorlati Agrofórum 17(7): 27-28.

JAKAB P. (2006a): A műtrágyázás és a talajbaktérium trágyázás hatása az őszi búza termésére és minőségére. In: XII. Ifjúsági Tudományos Fórum. Konferencia helye, ideje: Keszthely, Magyarország, 2006.04.20 PATE Georgikon Mezőgazdaságtudományi Kar, CD.

JAKAB P. (2006b): Application of soil bacterium preparation in winter wheat production. In: Sz Hidvégi (szerk.) Proceedings of the V. Alps-Adria Scientific Workshop. Cereal Research Communications Vol 34 No. 1. Konferencia helye, ideje: Opladen, Horvátország, 2006.03.06-2006.03.11. Budapest. 5-7.

JAKAB P. (2010): Talajbaktérium készítmények alkalmazása a fenntartható növénytermesztésben. Összefoglaló. In: Kóródi M. (szerk.): Tudomány határok nélkül: Válságjelenségek összefüggései a gazdaságban és a társadalomban. Szolnoki Főiskola, Szolnok. Pp. 99.

JAKAB P., FUTÓ Z., LÉVAI K., NAGY P. (2004): A tápanyagellátás hatása az őszi búza fajták termésére. Összefoglaló. In: Kalmár I. (szerk.): IV. Alföldi Tudományos Tájgazdálkodási Napok]. Tessedik Sámuel Főiskola Mezőgazdasági Főiskolai Kar, Mezőtúr. Pp.113.

JAKAB P., FESTŐ D., KOMAREK L. (2016): A műtrágyázás hatása az őszi búza termésére és terméskép̋ző elemeire. In: Futó Zoltán (szerk.): Kihívások a mai modern mezőgazdaságban. Konferencia helye, ideje: Szarvas, Magyarország, 2016.11.24 Szarvas. Szent István Egyetemi Kiadó. Pp. 68-73. (ISBN:978-963-269-594-5)

JOLÁNKAI M., LŐVEI I., BALIKO E. (1990): Agrotechnikai tényezők hatása a búza minőségére. Élelmezési Ipar 44: 125-127.

KOMAREK L. (2007): A Dél-Alföldi Régió súlyának, szerepének alakulása a hazai agrártermelésben. COMITATUS: ÖNKORMÁNYZATI SZEMLE 17(9): 52-64.

KOMAREK L. (2008): A Dél-Alföld agrárszerkezetének sajátosságai. Szeged: Csongrád Megyei Agrár Információs Szolgáltató és Oktatásszervező Kht, 143. (ISBN:978-963-06-5325-1)

PEPÓ P. (2005): Effect of crop year, genetic and agrotechnical factors on dry matter production and accumulation in winter wheat production. Cereal Research Communications 33(1): 29-32.

RAGASITS M., SZABÓ M. (1992): A búza minősége. In: Bocz E. (szerk.): Szántóföldi növénytermesztés. Mezőgazdasági Kiadó, Budapest. Pp. 273-282.

SÁRVÁRI M. (1984): A vetésváltás és a tápanyagellátás hatása a búza és a kukorica termésére. Kandidátusi értekezés tézisei. Debrecen. Pp. 48.

TANÁCS L., MATUZ J., GERŐ L., KOVÁCS K. (1993): Műtrágyázott őszi búzafajták sütőipari paramétereinek alakulása. Növénytermelés 42(6): 509-518.

TANÁCS L., MATUZ J., BARTÓK T., GERŐ L. (1997): Az NPK-műtrágyázás hatása az őszi búza szemtermésének aminosav összetételére. Növénytermelés 46(1): 43-51.

TANÁCS L., MATUZ J., PETRÓCZI I.M., KOVÁCS ZS. (2000): Vegyszeres állománykezelések hatása a búzafajták szemtermésének sikértartalmára, sikérterülésére és esésszámára. Növénytermelés 49(5): 487-499.
TANÁCS L., GERŐ L. (2002): Fungiciddel kezelt két őszibúza-fajta sikértartalmának, terülésének és esésszámának alakulása. Növénytermelés 51(5): 497-507.
TANÁCS L. (2005): Élelmiszer-ipari nyersanyagismeret. Szaktudás Kiadó Ház. Budapest. 396 p. ISBN: 963 9553 47 6

Review on Agriculture and Rural Development 2017 vol. 6 (1-2) ISSN 2063-4803

REVEALING THE OPINION CLIMATES OF FRUIT PRODUCERS AND THEIR SALES CONNECTION

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ABSTRACT
Although researches on the subject of business relationships indicate that the quality of the relationship between the partners is a central element of effective cooperation, it can still be considered an unexplored territory. This paper aims to reveal the relationship of fruit producers and customers, based on relationship quality, as well as determining what customer cooperation is regarded by fruit producers as the most favourable . The survey was conducted between 2013 and 2014, involving 223 producers from Szabolcs-Szatmár-Bereg County, to evaluate their customer cooperation. The results of the evaluation concluded that producers value factors of relationship quality in their cooperation with sales channels differently. Their opinions reflect that overall the most favourable relationship exists between producers and agricultural cooperatives. The main reason is that this cooperation is primarily based on trust, commitment and friendship, where there is typically no conflict among parties and they mutually accept dependence. Since the results of the evaluation clearly reflected that producers value cooperation differently regarding the factors of relationship quality with respect to the various sales channels, further research is justified to reveal correlations between various relationship evaluations (opinion climates) and performance as well as devoting more attention to relationships among the various factors.

Keywords: supply chain, relationship quality, trust, commitment, adaptation

INTRODUCTION

Currently the significance of the business relationships has become more relevant, so for its evaluation, scientists created the definition of "relationship quality", which is widely used. The relationship quality reflects the behaviour and emotions within a customer-supplier relationship, which can be seen as a higher construction with factors that indicate the relationship between them (HENNIG-THURAU ET AL., 2002). In this sense the quality of the relationship can be determined from the behaviour of the parties, how they behave with each other and the types of emotional interactions, which essentially provide the foundation for maintaining and developing the relationship. The factors determining the relationship quality are usually indicated differently by various authors, but in some research results overlaps and combinations can be detected as well. CROSBY ET AL. (1990) identified trust and satisfaction as the main elements of relationship quality. SMITH (1998) during the investigation of the quality of customer-supplier relationships, clearly stated that trust, satisfaction and commitment are the key elements, which was reinforced by ULAGA AND EGGERT (2004). It is clear that trust, commitment and satisfaction are the most commonly mentioned and widely accepted among all the factors used to determine relationship quality. Apart from the three main factors, conflict, adaptation (KUMAR ET AL., 1995), loyalty (HETESI AND VILMÁNYI, 2013), and the quality of service (RAUYRUEN ET AL., 2007) were mentioned in the works of several authors. It is obvious that there is no generally accepted consensus concerning which factors would describe accurately the relationship quality of cooperation between businesses, still based on previous studies, the factors that enable us to gain a comprehensive understanding can be determined as well as those that can help us to make evaluations. In my research, I marked factors determining

the relationship quality of those widely accepted elements, also supported by empirical results that give a broad description of the relationship quality and with their application, the relationship between the parties becomes measurable. These are trust, commitment, dependence, adaptation, lack of conflict and friendship. The significance of business relationships is clearly unquestionable. On the other hand, it is still unclear why some business relationships can work effectively, while others cannot, and what factors qualify cooperation either good or bad. The focus of my paper is the evaluation of cooperation between businesses from the aspect of relationship quality of relationship. Evaluating the quality of their relationship is crucial as it enables general assessment of the strength of the relationship between the business partners as well as the degree to which the expectations and hopes of the parties were fulfilled, based on successful or unsuccessful business events (CROSBY ET AL., 1990). The main purpose of this paper is the evaluation of the quality of the fruit-producer customer cooperation along the defining factors.

MATERIAL AND METHOD

This research aims to reveal the customer relationship of fruit producers from the aspect of the relationship quality. The survey was taken between 2013 and 2014, involving 223 farmers from Szabolcs-Szatmár-Bereg County to evaluate their customer cooperation from the aspect of relationship quality. The reason for the territorial limitation is justified by the significance of the producers of Szabolcs-Szatmár-Bereg County, as they are key fruit suppliers of the entire country. The importance of agriculture in the county is - as reflected in their contribution to the GDP - more than double than the national average, as well as the ratio fruit-production areas of the county are 5%, while the nation-wide average is 1%, representing one-third of the domestic crops (KSH, 2016). The survey aimed to reveal the opinion of fruit-producers, especially the ones producing apple and plum varieties. The total amount of fruit-bearing cropland was in Szabolcs-Szatmár-Bereg County was determined on the basis of the integrated applications submitted for direct financial funds. In the county, producers of apple and plum varieties farm on 60,491 acres, the farmers who filled out the survey produce on 2,661 acres in total. In total, 4.4% of farmland in Szabolcs-Szatmár-Bereg County was evaluated in this survey. Based on the results of the secondary research, I identified those factors which can be used to comprehensively describe the business cooperation. Thus, I identified trust, commitment, lack of conflict, dependence, companionship and adaptation as the key factors of relationship quality (*Figure 1*).

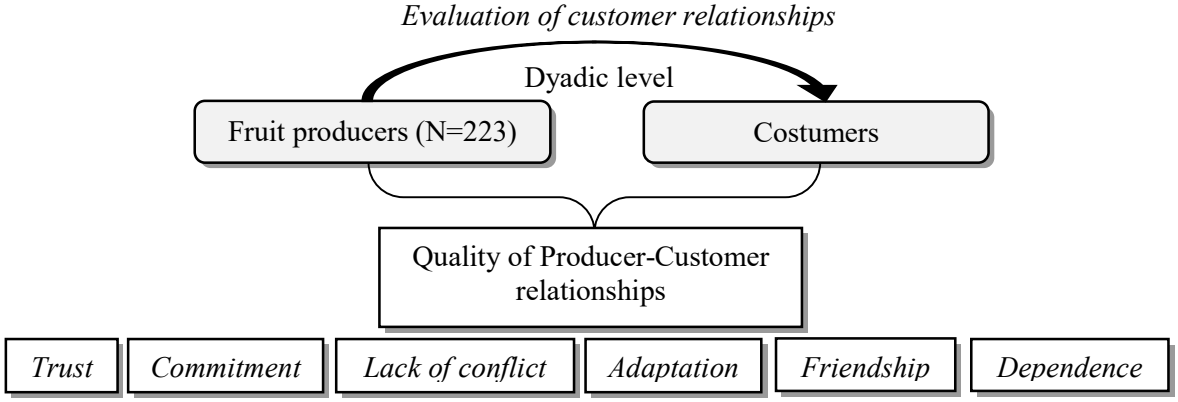

Figure 1. Specifying the area of research
Source: Noémi Ványi – own compilation

The primary collection of data aimed to reveal the relationships of fruit producers and their customers; that is the quality of relationship between the parties. In the survey I linked statements to the selected relationship quality factors, which then had to be evaluated on a Likert scale from 1 to 5. The smallest value (1) represents absolute opposite, while the highest value represents complete agreement, and the respondents could mark the value that represented their opinion on the different statements the most. The evaluation of the producers was transferred to an index scale in order to have interpretable and expressive table where the changes in positive or negative direction can be clearly identified. The value of the index scale is a number between +100 and -100. The value of 100 means that the respondents indicated the highest value (5) so the statement is completely representative of their relationship with the customer. The value below 0 represents negative opinion (e.g. lack of trust, lack of commitment, conflict, etc.). The value of -100 this way means that the respondents indicated the lowest value considering the relevance of the statement, meaning that it is not at all relevant to their relationship with the customers. The evaluation of data was done with SPSS mathematical-statistical software.

RESULTS

When charting the producer - customer relationships, the respondents indicated - based on the most significant coordination channels of the vegetable-fruit sector - what percentage of their products are sold via merchandising, on PSO/PG (Producer Sales Cooperative, Producer Groups), through retail, via intermediary trader, processing plant or other commercial channels. Through the questions connected to these commercial channels I investigated whether based on the sales networks of the farmers we can separate those groups that are significantly similar, and can clearly be differentiated from other groups. The classification based on the 8 criteria variable was not done with hierarchical clustering methods, K-centre method. After testing solutions of two and four clusters, I chose the three-cluster solution, because in that case, the number of the required optimization steps is minimal, and this way the clusters can be understood the most clearly. The obtained clusters can be understood based on cluster centres. As a result of cluster analysis I determined that taking all 8 options, the farmers are aligned in 3 typical, well separated, more or less solid groups. So each member of the N=223 sized sample can be taken as a member of a cluster. The cluster centres differ significantly along all the cluster making variables. The labelling of the clusters was made on the basis of the farmer's typical marketing connections. The result of the evaluation shows that when taking the typical commercial g channels, we can distinguish 3 clusters: 1. "Multiple channel commercial" cluster, 2. Intermediary trader cluster, 3. PSO/PG cluster. The „multiple-channel commercial" cluster includes 42 % of the respondents. Members of this cluster sell their products through multiple channels, and there is not one channel with higher importance. Most of the farmers in this cluster are connected to processing plants, wholesale units and intermediary traders. Since there is not one well separable commercial channel, this cluster was labelled as the "multiple channels". Members of the 2nd cluster typically sell their products to intermediary traders, who make up 42% of all traders. Members of the PSO/PG cluster make up the smallest group (16%), where producers are typically connected to PSO/PG.

4.1. The quality of the commercial relationships of farmers

In the next phase of the evaluation I researched the relationship between farmers and the three commercial clusters. The evaluation was based on the general responses of the farmers on the relationship quality (*Table 1*).

Table 1. Evaluation of commercial clusters based on the quality of relationships

Relationship quality factors	Commercial clusters		
	„multi-channel" commerce	**Intermediary trader**	**PSO/PG**
Lack of conflicts	30.91	48.14	42.36
Trust	19.65	37.41	27.01
Dependence	1.08	-7.02	10.56
Commitment	-1.29	-6.60	14.72
Friendship	-8.33	-10.64	19.64
Adaptation	-18.95	-38.96	-14.58

*based on balance index

Source: Noémi Ványi – own compilation

We can see from the results in the table above, that the factors of trust and lack of conflict were considered steadily positive among the respondents of all three commercial clusters. Adaptation on the other hand was regarded negative in all clusters among the farmers, meaning that relation-specific investments are not being made despite trust and lack of conflict being the foundation of their cooperation. Those connected to multiple channels do not perform adaptation, their cooperation is limited to business and they do not establish commitment towards their partner. On the other hand, they trust their partner, their relationship is not characterised by conflicts and they do not feel dependent on each other. The respondents who cooperate with intermediary traders indicated the most positive evaluations on the factors of lack of conflict and trust, but the least positive ratings on commitment, dependence and friendship. Despite of the fact that in the cooperation the level of trust is the highest and the amount of conflicts is the lowest, adaptation still represented the lowest rating. Consequently, despite trust and lack of conflict, the producer might still have reservations about the relationship, resulting in the lack of adaptation. The negative rating of commitment reflects the same uncertainty, that even though the respondents trust their partners, they are still not committed to them. In this cluster, the respondents feel independent from their customers and they do not form common friendship with their partners. In the PSO/PG cluster, only adaptation received a negative rating, the other 5 factors of relationship quality were considered positive. It is important to mention that only among the farmers connected to PSO/PG felt committed to their partners and only in this cooperation can we detect friendship among them. From the results it is apparent that the producers who cooperate with certain commercial clusters evaluate the factors of the relationship quality differently. I concluded from the evaluations of the members of the three clusters, that the members of the PSO/PG clusters evaluate the relationship quality factors most positively.

4.2. Classifying the evaluation of customer cooperation

Researches show that producers in different cooperation evaluate differently the relationship quality factors. For this reason, in order to reveal the opinion climate, I did cluster evaluation. The classification was done once again with K-centre method. As a result of cluster analysis, I allocated that taking all 6 relational factors, based on their responses, the farmers are aligned in 3 typical, well separated, more or less solid groups.

The cluster centres are significantly different besides all cluster making variables. Based on the results, I came to the conclusion that producers are aligned to three well separated groups: 1, respondents with „nuanced views" 2. Negative respondents and 3. Positive respondents (*Figure 2*).

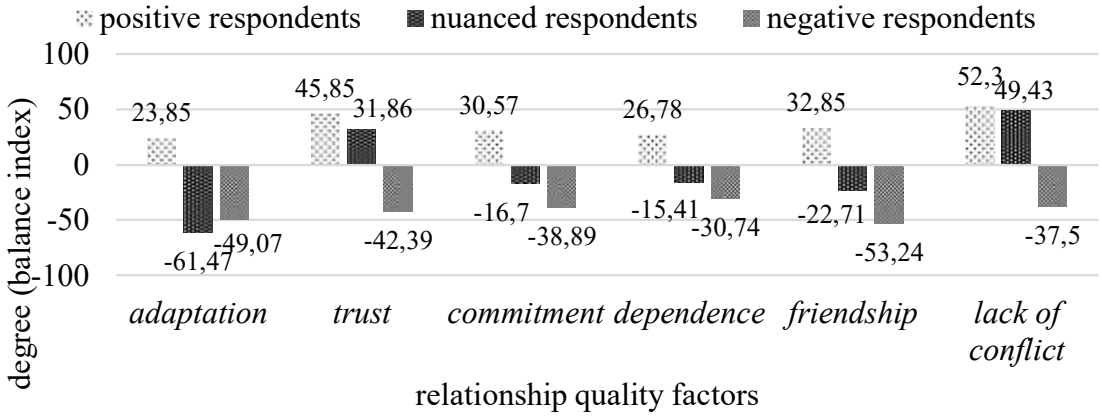

Figure 2. Relationship evaluation clusters related to customers
Source: Noémi Ványi – own compilation

The labels of the clusters represent that fundamentally, a general attitude is shapes the rating, and the factors of the ratings in themselves are not that relevant. The negative respondents cluster represent the least of all respondents (12%). They rated all 6 factors of relational quality negative. Respondents belonging to this cluster do not feel that they depend on their customers and that there are frequent conflicts between them. Cooperation is limited to transactions and the lack of trust and commitment characterises their relationship. They do not make investments in the interest of their relationships. Most respondents belong to the cluster of respondents with nuanced views. Respondents in this group also trust their customers however, there is no commitment among them and there is no adaptation in order to maintain cooperation. The producers do not feel that they depend on their partners and conflict is not present in their relationships. Their relationship is only limited to transactions. 39% of the respondents belong to the cluster of positive respondents. The foundation of the relationship among the respondents belonging to this group is trust and commitment and they feel that they depend on their customers. Cooperation goes beyond business relationships and can almost be called a friendship. Their relationship with customers is characterised by lack of conflict and they make investments in the interest of their relationships. The correlation between sales and the opinion cluster was evaluated in across table. Because of the result of the evaluation, I dismissed my null hypothesis, and found that among the sales and opinion clusters there is a significant correlation. The results of the evaluation on the interval table can be seen in *Table 2*.

Table 2. Cross table based on the clusters

Opinion clusters	Sales Clusters			Total
	„multiple channels"	intermediary trader	PSO/PG	
"nuanced" opinion	40.90%	62.80%	33.30%	48.90%
negative opinion	19.40%	4.30%	13.90%	12.10%
positive opinion	39.80%	33.00%	52.80%	39.00%
Total	100.00%	100.00%	100.00%	100.00%

Source: Noémi Ványi – own compilation

Based on the results I came to the conclusion that the respondents regarded the cooperation with PSO/PG 52.8% positively, 13.9% negatively and 33.3% nuanced. The producers in this cluster – compared to the results of other clusters – considered their relationship the most favourably. 62% of the respondents considered their cooperation with intermediary trader as nuanced, and 33% positively. In this cluster, only 4.3% of the responders gave a negative rating. The ones trading via "multiple channels" rated their relationship with customers nuanced in 40.9% and almost to the same extent (39.8%) positively. 19.4% of the respondents rated their relationship with partners negatively, so in comparison to the other two clusters, here is the highest ratio for negative ratings. Based on these results, I came to the conclusion that the overall positive climate of opinion is most likely to form in the PSO/PG sales cluster. In the intermediary trader cluster the nuanced climate of opinion is typical, and finally in the "multiple channels" cluster, the ratio of negative climate of opinion is slightly above average.

CONCLUSIONS

Although the research done on the subject of business relationships indicate that the quality of the relationship between the partners is the central element of effective cooperation, that the parties in the supply chain can still be considered as an unexplored territory. This current paper is aimed at revealing relationship among fruit producers in the function of relationship quality to identify the most favourable form of customer cooperation. Over the course of the evaluation of producer – customer relationship I found that producers can be classified into three distinct groups based on their typical sales relationships. These are the „multiple channels" sales cluster, intermediary trader cluster and agricultural cooperative cluster, and one where the producers evaluate factors determining relationship quality with a nuanced opinion. Producers in all three clusters feel that their relationship is based in trust and the cooperation lacks conflict, however adaptation among parties is not typical in either cooperation. The most favourable evaluation can be observed among producers belonging to the agricultural cooperative cluster based on the factors. Results of further evaluation support that producers can be classified into three distinct groups according to their opinions: respondents with „nuanced" views, negative respondents, and positive respondents. Overall it can be stated that positive opinion climate was most likely in the agricultural cooperative cluster. Cooperation here is primarily based on trust, commitment and friendship, where there is a lack of conflict among parties and they mutually accept dependence.

REFERENCES

CROSBY, LL.A., EVANS, K.R., COWLES, D. (1990): Relationship quality in services selling: an interpersonal influence. Journal of Marketing 54: 68-81.

HENNIG-THURAU, T., GWINNER, K.P., GREMLER, D.D. (2002): Understanding relationship marketing outcomes. Journal of Service Research 4: 230-247.

HETESI, E., VILMÁNYI, M. (2013): A dinamikus kapcsolati képességek és a lojalitás szerepe a szervezetközi kapcsolatokban. In: Bajmócy, Z., Elekes, Z. (eds.): Innováció: a vállalati stratégiától a társadalmi stratégiáig. JATEPress, Szeged, pp. 176-191.

KSH (2016): Központi Statisztikai Hivatal, https://www.ksh.hu/docs/hun/agrar/agrarium2016/agrarium_2016_15sz.pdf

KUMAR, N., SHEER, L.K., STEENKAMP, J-B.E.M. (1995): The effects of perceived interdependence on dealer attitudes. Journal of Marketing Research 32: 348-356.
RAUYRUEN, P., MILLER, K.E., BARRETT, N.J. (2007): Relationship quality as a predictor of B2B customer loyalty. Journal of Business Research 60(1): 21-31. doi: 10.1016/j.jbusres2005.11.006
SMITH, J.B. (1998): Buyer-seller relationships: similarity, relationship management, and quality. Psychology and Marketing. 15(1): 3-21.
ULAGA, W., EGGERT, A. (2004): Relationship value and relationship quality. European Journal of Marketing 40(3/4): 311-327.

Review on Agriculture and Rural Development 2017 vol. 6 (1-2) ISSN 2063-4803

THE EFFECT OF FOLIAR FERTILIZATION ON THE YIELD AND QUALITY PARAMETERS OF MAIZE GRAIN

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ABSTRACT
In our small plot experiment, we examined the effect foliar fertilization on the yield and quality parameters of maize grain in 2016. The experiment was set in three replications, random blocks on the area of Tangazdaság Ltd. in Hódmezővásárhely. The soil of the experiment was meadow chernozem. We sprayed out three different foliar fertilizer products individually and combined with each other as well, so there were six treatments and the control to be examined. The year 2016 was favourable for maize production. In 2016 the amount of precipitation in the vegetative period of corn was higher by 23.7 mm than the average. We processed the obtained data by single factor variant analysis. We obtained 11.37 t/ha in control treatment, and with the foliar fertilization the yield ranged between 11.61-12.86 t/ha. The foliar fertilization products increased the yield of corn, but this difference was not significant. By the application of foliar fertilization, the qualty parameters of maize grain improved in many cases. Our scientific results proved, that foliar fertilization had god effect on the yield and quality parameters of maize.

Keywords: maize, foliar fertilization, yield, crude protein content, starch content

INTRODUCTION

The genetical productivity of the newest maize hybrids is continuously growing. In order that the potential of hybrids productive capacity can be utilized as much as possible, the harmony of the agro-technical factors is necessary (KOVÁCS AND SÁRVÁRI, 2016).
The low average yield in maize production can be due to the fall-back of chemical fertilization; this is why the use of fertilizers must be increased in order to reach higher and more consistent amounts of crop (KOMAREK, 2007).
In practice, foliar fertilisers are able to meet only a few percent of the main macroelement demands of plants. Foliar fertilisation cannot provide nutrient uptake through the soil, just supplements it. The foliar fertiliser can get directly to the place of use, the leaf cells and can act immediately without the mediation of the soil. Nutrient uptake can be sustained even in drought, with little water. Under ideal conditions, the nutrient utilisation might reach 100% (KÁDÁR, 2002).
According to KÁDÁR (2008) the future spread of foliar fertilisation must be grounded by comprehensive experimental research. Accurate, repeated small plot trials are necessary to clarify the factors influencing the effectiveness of foliar fertilizers and recommendations must be developed for consultation.
Nowodays, in order to achieve high yields, cultivated plants cannot always get enough microelements from the soil, therefore the importance of foliar fertilization increased. The timing is decisive for rapid and effective intervention to prevent yield loss or deterioration, and we can achieve yield increase and quality improvement as well. With the application of foliar fertilization, we can increase the resistance of corn against the ecological stress factors, diseases and pests as well (HOFFMANN ET AL., 2004).

Foliar fertilization had good effect in maize production on meadow chernozem soil, wich. contains a lot of phosphorus and a few amount of Zn. The foliar fertilization products can decrease the yield fluctuation and increase the yield amount. (JAKAB ET AL., 2014a; JAKAB ET AL., 2014b; JAKAB ET AL., 2016a; JAKAB ET AL., 2016b; JAKAB ET AL., 2016c; ZOLTÁN AND JAKAB, 2016; JAKAB AND KOMAREK, 2017).

MATERIAL AND METHOD

Soil properties of the experimental field

The research work has been carried out at the SZTE Tangazdaság Ltd. in Hódmezővásárhely. The soil was meadow chernozem, the reaction of which was nearly neutral (pH_{KCL} 7.17). Before setting the experiment, the soil analysis data showed that it had good nitrogen, and very good phosphor and potassium contents. The Zn content was low (*Table 1*).

Table 1. Main properties of the experimental field area

pH (KCL)	P_2O_5 (mg/kg)	K_2O (mg/kg)	Humus (%)	Soil plasticity value (K_A)	Zn (mg/kg)
7.17	336	620	3.39	48	1.76

Weather in the experimental years

The year 2016 was favourable for corn production. In 2016 the amount of precipitation in the vegetative period of corn was higher by 23.7 mm than the average (*Table 2*). The average temperature showed a positive deviation compared to the average of several years. The positive deviation of average temperature together with deficient precipitation had a positive effect on the development of corn, which resulted high yields.

Table 2. The amount of rainfall in the vegetative period of maize in 2016

Month	Rainfall (mm)	50 years average rainfall (mm)	Difference (mm)
April	19.4	39.9	-20.5
May	38.8	58	-19.2
June	86.0	75.3	10.7
July	106	58.7	47.3
August	47.6	48.7	-1.1
September	47.2	40.7	6.5
Total amount of rainfall (mm)	**345.0**	**321.3**	**23.7**

Main features of the agro-technology applied

The small plot experiment was set in three replications, organised as a random block in 2016. The fore-crop was winter wheat. Fall tillage involved deep ploughing at 30 cm depth in the experimental year. The sowing date was on 14 th of April. Plant density was 70.000/ha. The examined hybrid was Limanova (FAO 370). We applied three products individually and combined with each other as well, so there were six treatments and the control plot. The products were the followings: Algafix, Amalgerol and Fitohorm Turbo

Zn. The foliar fertilization was applied once in 6-7 leaves stage of plants. We harvested the plots by hand. We processed the obtained data by single factor variant analysis.

RESULTS

Due to the favourable ecological conditions the yield of the control plot was 11.37 t/ha. With the application foliar fertilization the yield ranged between 11.61-12.86 t/ha. The foliar fertilization treatments increased the maize yield compared to the control, but it was not significant. We obtained the highest yield in the Amalgerol treatment (12.86 t/ha). We got high yield in Algafix + Amalgerol (12.34 t/ha) and Algafix + Fitohorm Turbo Zn treatment (*Figure 1*).

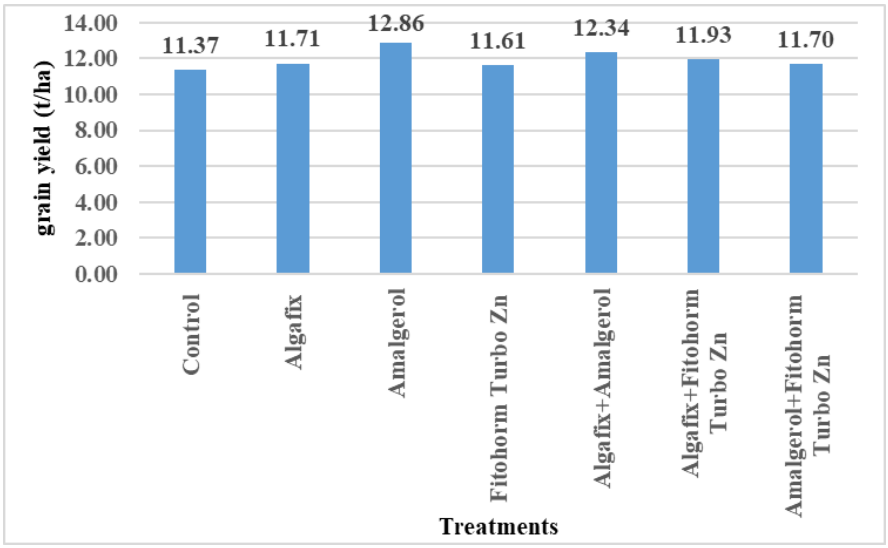

Figure 1. The yield of maize in control and different foliar fertilization treatment

We examined the effect of foliar fertilization on the main quality parameters (dry matter content, crude protein content, starch content) of maize. The dry matter content was 86.62 % in control treatment. Under the influence of foliar fertilizer treatments the dry matter content ranged between 86.37-87.25%. Several treatments increased this parameter, but the change was not significant (*Figure 2*).

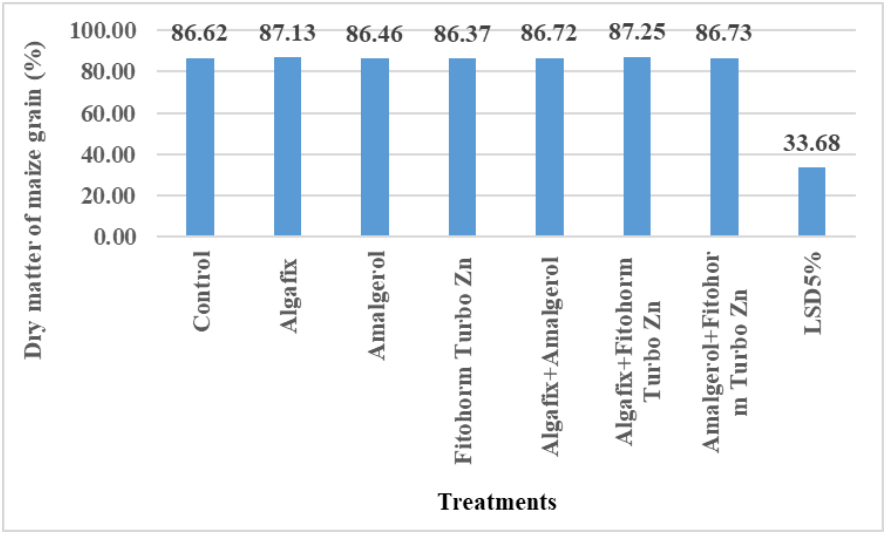

Figure 2. The effect of fertilizer treatments on the dry matter content of maize grain

The value of crude protein (77.95 g/kg) was the lowest in control treatment. In treated parcels we measured higher values (77.36-78.88 g/kg), but the difference wasn't significant between control and treated results. The highest value we got in Algafix + Amalgerol treatment (78.88 g/kg) (*Figure 3*).

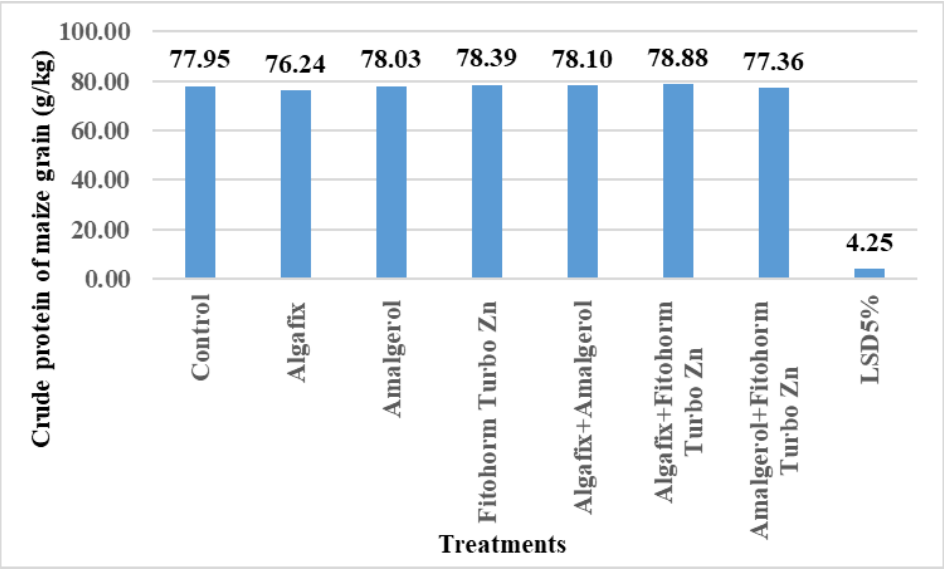

Figure 3. The effect of fertilizer treatments on the crude protein content of maize grain

The starch content of control treatment was 644.13 g/kg. We measured the highest value (655.03 g/kg) in Amalgerol treatment. In Algafix + Amalgerol and Amalgerol + Fitohorm Turbo Zn treatments we measured significantly lower values (626.0 g/kg) compared the control treatment (*Figure 4*).

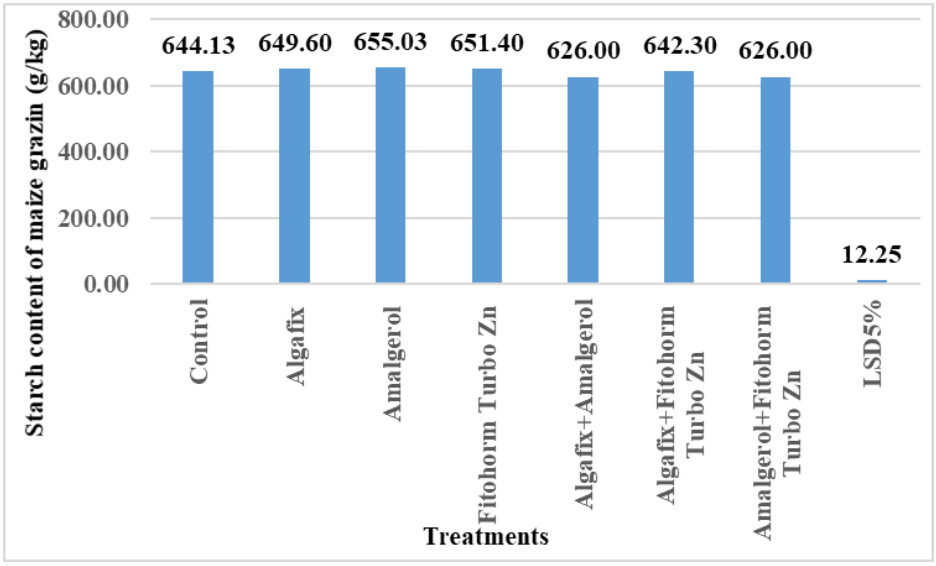

Figure 4. The effect of fertilizer treatments on the starch content of maize grain

CONCLUSIONS

The year 2016 was favourable for maize production therefore we obtained relatively high yield (11.37 t/ha) in non treated parcells. Under the influence the foliar fertilization the

yield increased. In treated plots the yield ranged between 11.61-12.86 t/ha. The yield increasement compared the control was not significant. We examined the effect of foliar fertilizer treatment on the main quality parameters of maize grain. The foliar fertilizer products had good effect on the examined quality parameters, because in many cases improved the examined parameters. Our scientific results proved, that the foliar fertilization had favourable effect on the yield and quality parameters of maize, therefore it will be higher importance in the future in maize production.

REFERENCES

HOFFMANN R.-VARGA CS.-KARIKA A. (2014): Levéltrágyázás a gyakorlatban. Agrárium. 24(8): 69-72.

JAKAB P., KOMAREK L. (2017): The effect of foliar application on different fertilizers on technological and economical parameters of maize. Infrastructure and Ecology of Rural Areas, Krakow, (in. presss)

JAKAB P., SÜLI Á., NAGY P., KRISTÓ I. (2014a): The effect of foliar fertilization on the yield, chemical composition and nutrient value of maize. Lucrari Stiincifice Management Agricol 16(1): 202-205.

JAKAB P., NAGY P., KRISTÓ I. (2014b): Environmentally friendly nutrient supply of maize. Review on Agriculture and Rural Development 3(1): 320-323.

JAKAB P., ZOLTÁN G., KOMAREK L. (2016): The effect of foliar fertilization on the yield and generative factors of maize. Review on Agriculture and Rural Development 5(1-2): 158-161.

KÁDÁR I. (2002): Levéltrágyázás jelentősége és szerepe a növénytáplálásban. Az elméleti alapok összefoglalása. Gyakorlati Agrofórum 12: 7-10.

KÁDÁR I. (2008): A levéltrágyázás jelentősége és szerepe a növénytáplálásban. Acta Agronomica Óváriensis 50(1): 19-27.

KOMAREK L. (2007): A Dél-Alföldi Régió súlyának, szerepének alakulása a hazai agrártermelésben. COMITATUS: ÖNKORMÁNYZATI SZEMLE 17(9) 52-64.

KOVÁCS P., SÁRVÁRI M. (2016): The effect of some agrotechnical factors on the yield of maize hybrids with different genetic base. Növénytermelés 65. (Supplement): 103-106.

JAKAB P., PETER SZUCSNE J., SÜLI Á., BENK Á. (2016b): Study of foliar fertilization on the yield, chemical composition and nutrient value of corn. Lucrari tiintifice Management Agricol 18(1): 123-126.

JAKAB P., KOMAREK L., ZOLTÁN G. (2016c): The study of foliar fertilization in maize production, In: Futó Z. (szerk.): Kihívások a mai modern mezőgazdaságban. Magyar Tudomány Napja Konferencia Kiadványa, Szent István Egyetemi Kiadó, Gödöllő pp. 197-202.

ZOLTÁN G., JAKAB P. (2016): Lombtrágya készítmények hatása a kukorica termésére és beltartalmára. In: Szalka É., Bali Papp Á. (szerk.): XXXVI. Óvári Tudományos Nap: Hagyomány és innováció az agrár- és élelmiszergazdaságban II. 335 p. Konferencia helye, ideje: Mosonmagyaróvár, Magyarország, 2016.11.10 Mosonmagyaróvár: Széchenyi István Egyetem Mezőgazdaság- és Élelmiszertudományi Kar, 2016. pp. 246-251. (ISBN 978-615-5391-79-8)